RADIO NEWS

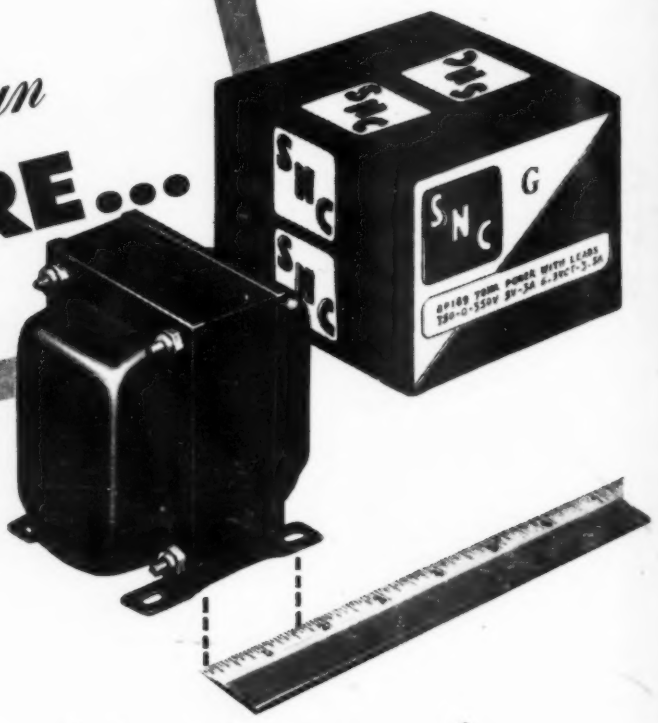
MARCH
1948

RADIO-ELECTRONIC
ENGINEERING
EDITION

COMPACT HAM STATION FOR LIMITED SPACE

Quality you can

MEASURE...



makes every

SNC TRANSFORMER *give outstanding performance*

SNC TRANSFORMERS

Join the increasingly large number of manufacturers, retailers, hams and other component part buyers who rely on SNC for quality, trouble-free equipment. Write for catalog today.

Place a rule against the stack of an SNC No. 8P189 transformer and the *extra* width clearly indicates the added quality built into every item in the complete SNC line.

Skillful engineering, latest production techniques and highest quality materials . . . backed by careful workmanship, exacting step-by-step inspection and rigorous final testing . . . are just a few of the reasons why SNC transformers keep rejects at a minimum and give outstanding performance.

Remember! SNC gives MORE applications with SMALLER inventories for GREATER profits!

SNC MANUFACTURING CO., INC.

Quality Transformers

WEST LAKE AVE. NEAR LEHIGH • GLENVIEW, ILLINOIS

Export Department, 308 W. Washington St., Chicago 6, Illinois, U.S.A.

KIT 1 (left) I send you Soldering Equipment and Radio Parts; show you how to do Radio Soldering; how to mount and connect Radio parts; give you practical experience.

KIT 2 (left) Early in my course I show you how to build this N. R. I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn EXTRA money in spare time.

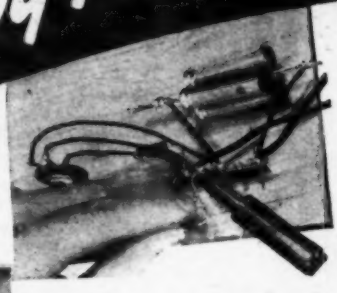
VETERANS

You can get this training in your own home under G. I. Bill. Mail coupon for full details.

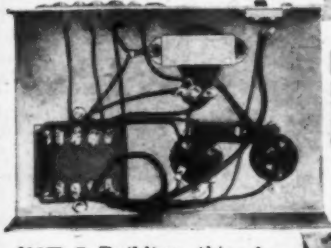
Be a RADIO Technician

Learn by PRACTICING in Spare Time

with BIG KITS of RADIO PARTS I send you



KIT 3 You get parts to build Radio Circuits; then test them; see how they work, learn how to design special circuits; how to locate and repair circuit defects.



KIT 4 You get parts to build this Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds; learn to correct power pack troubles.

KIT 5 Building this A. M. Signal Generator gives you more valuable experience. It provides amplitude-modulated signals for many tests and experiments.

KIT 6 You build this Superheterodyne Receiver which brings in local and distant stations—and gives you more experience to help you win success in Radio.

My Course Includes Training in

TELEVISION • ELECTRONICS

FREQUENCY MODULATION

Do you want a good-pay job in the fast-growing Radio Industry—or your own Radio Shop? Mail the Coupon for a Sample Lesson and my 64-page book, "How to Be a Success in Radio-Television-Electronics," both FREE. See how I will train you at home—how you get practical Radio experience building, testing Radio circuits with BIG KITS OF PARTS I send!

Many Beginners Soon Make Extra Money In Spare Time While Learning

The day you enroll I start sending EXTRA MONEY manuals that show how to make EXTRA money fixing neighbors' Radios in spare time while still learning! It's probably easier to get started now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even *greater* opportunities as public demand for Television, FM and Electronics devices continues to grow! Send for FREE books now!

Find Out What NRI Can Do For You

Mail Coupon for Sample Lesson and my FREE 64-page book. Read the details about my Course; letters from men I trained; see how quickly, easily you can get started. No obligation! Just MAIL COUPON NOW in envelope or paste on penny postal. **J. E. SMITH, President, Dept. 8CR, National Radio Institute,** *Pioneer Home Study Radio School,* **Washington 9, D. C.**

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Sample Lesson 64 Page Book **FREE**

Mr. J. E. SMITH, President, Dept. 8CR
National Radio Institute, Washington 9, D.C.

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First in radio-electronics

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COVER PHOTO: Remote control of hi-power transmitter permits compact operating position for ham station. Rotary beam indicator, SX-43 receiver, wire recorder, HT-18 exciter (driving a BC-610E) and Panadapter comprise this installation. (Staff Photo by Arthur E. Haug)

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DEPARTMENTS

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low priced ham shack $97.00

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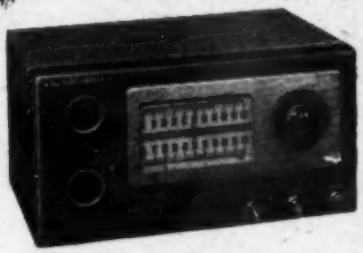
hallicrafters
COULD DO IT!

RECEIVER

S-38

Hallicrafters famous Model S-38. Recognized by hams, beginning hams and all who know the unending fascination of world wide communications, as one of the greatest receiver values on the market today. Overall frequency range from 540 kc to 32 Mc in four bands. Main tuning dial calibrated with precision accuracy. Separate electrical bandspread dial. CW pitch control adjustable from front panel, automatic noise limiter, self-contained PM dynamic speaker. 105-125 volt AC/DC. **$47.50**



TRANSMITTER

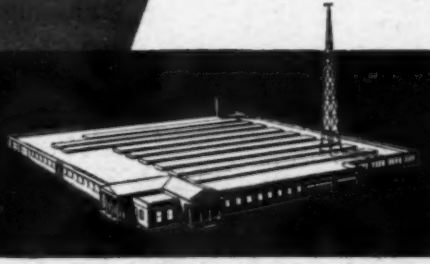
HT-17

The Model HT-17 is a low power, high quality transmitter now available at a new low price. Real Hallicrafters performance with maximum convenience and economy. Provides an honest 10 to 20 watts of crystal-controlled CW output on the amateur 3.5, 7, 14, 21 and 28 megacycle bands. A pi-section matching network is an integral part of the plate circuit and, together with an adjustable link, provides coupling to any type of antenna or permits the HT-17 to be used as an exciter for a high power final amplifier. Take advantage of this money saving offer Now! 40-meter coils included..... **$49.50**

YOU SAVE $20.00

BE ON THE AIR FOR LESS THAN $100.00. Build yourself a ham shack with the best equipment available at these low prices. Here's your chance to save money. You save exactly $20.00 at these prices. Your nearest Hallicrafters distributor will tell you what tremendous values these pieces of Hallicrafters represent. See him for demonstration and further details.

FOLLOW THE GATTI HALLICRAFTERS AFRICAN EXPEDITION. Sponsored by the Hallicrafters Co. and led by famed Commander Attilio Gatti, the mobile radio equipped expedition is now on location at the Mountains of the Moon in Africa. From four separate base camps the Expedition will communicate on regular schedule with all the world via short wave. Follow this scientific safari with your Hallicrafters equipment. Get detailed information on itinerary and schedules from your distributor.



hallicrafters RADIO

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 24, U. S. A.

Sole Hallicrafters Representative in Canada:
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ELIMINATE GUESSWORK!
Speed up your FM and AM Service

THE TWO General Electric units shown here are a team that will perform outstanding service feats on your bench. The Signal Generator YGS-3 and the 5" Oscilloscope CRO-5A not only eliminate guesswork but also eliminate a lot of your AM and FM service headaches.

Hook them up to the chassis on your bench—then: SEE THE PERFORMANCE OF EACH INDIVIDUAL STAGE.

The YGS-3 provides *adequate* output to operate the oscilloscope over *only one stage of I.F.* This means that each I.F. stage can be aligned separately.

This is only one of the many jobs that this versatile pair of units can accomplish for you. When you put them to work on your bench—they'll really prove to be a good right arm in your business.

RF level, AM modulation percentage and FM deviation are indicated and can be adjusted to standard levels.

THE CRO-5A OSCILLOSCOPE

This unit is of laboratory quality which makes it an extremely versatile unit in your shop. It has adequate sensitivity for all measurements including hum tracing.

All amplifier and sweep d-c potentials are electronically regulated to give a stable trace even under adverse power line variations. The unit is very sturdy in construction to withstand jars and vibrations. Tubes have been selected to give maximum amplification with minimum noise.

The 3" scope also may be used for visual alignment of radio receivers and general purpose oscilloscope work.

THE SIGNAL GENERATOR YGS-3
(FOUR UNITS COMBINED IN ONE)

1. RF Oscillator
2. FM Oscillator
3. Crystal calibrator
4. Variable frequency audio oscillator

This is really a compact job. Four basic units have been enclosed in a single cabinet to bring you one efficient, labor-saving portable equipment. Designed to simplify and speed up FM and AM receiver analysis, the YGS-3 provides:

- Extremely wide sweep deviation
- Reference level indicator for RF, audio, AM modulation percentage and FM deviation
- Constant output impedance attenuator
- Wide frequency range—100 KC to 150 MC on fundamentals for AM output and up to 200 MC for FM output
- High level output
- Lines up any FM or AM receiver, stage by stage by visual alignment methods.

Order these two units today. Let them begin to make your job easier right away.

New Booklet on FM Servicing:—Twenty-five cents (25¢).

For complete information write: *General Electric Company, Electronics Department, Electronics Park,* Syracuse, New York.

GENERAL ELECTRIC

164-81

I'll Send You 8 Big Kits of Training Equipment *including*

TWO-BAND 6 TUBE SUPER RECEIVER AND 16 RANGE METER SET-UP *for Testing*

PRACTICE WITH YOUR OWN HANDS!
Mind training through hand practice, that's the only way to LEARN and REMEMBER Radio. It's the most successful of Home Training methods.

OVER 175 PRACTICAL EXPERIMENTS
You'll find out how to build countless Radio Circuits. You'll learn a new, fast way to test Radio Sets without mfg. Equipment.

Learn Fast . . . Earn Fast

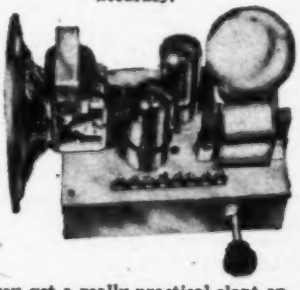
HOME TRAINING Planned For Your Needs

You Build All These

TESTERS . . . and MORE!

I give you a fine, moving-coil type Meter Instrument on Jewel Bearings—with parts for a complete Analyzer Circuit Continuity Tester. You learn how to check and correct Receiver defects with professional speed and accuracy.

Practice *Does It!*



Soldering, wiring, connecting Radio Parts . . . building circuits with your own hands—you can't beat this method of learning. When you construct this Rectifier and Filter Resistor and Condenser Tester, etc., you get a really practical slant on Radio that leads to a money-making future.

LOW COST HOME RADIO TRAINING!

Easy Monthly Payments!

My perfected Radio Training prepares you to start your own Radio Service Shop—or to land a big pay Radio job. With my help you get neighborhood Radio jobs while learning—*for extra cash and rich experience.* I train you RIGHT—by putting you to work with your hands in your own home during spare hours. You get 8 big kits of real professional Radio Parts and Equipment—and use them to build, test and trouble-shoot a powerful 6 tube superhet receiver, a 16 range test meter set-up and over 175 fascinating, instructive Radio experiments. My training is down-to-earth, really PRACTICAL—it's the Training you need to make money in Radio. Theory is cut to the bone—you don't need any previous schooling or experience. Sprayberry Training starts you out at the very beginning of Radio—the lessons are completely illustrated, simply written and easy to understand. Get the facts about Sprayberry Training NOW. Find out what it can do for you—prepare for amazing opportunities in Radio Servicing, Television, FM, Radar and Industrial Electronics. Fill out and mail coupon for my two big Books—FREE. No obligation—and no salesman will call. Mail coupon TODAY!

Building this Signal Generator and multi-purpose Tester will give you the kind of valuable experience and practice that is so important as a foundation for making good money in Radio. It makes a breeze out of fixing Radios, and you don't have to spend money on ready-made Equipment.

VETERANS
Approved for G. I. Training under Public Laws 16 and 346

MAIL COUPON FOR THESE 2 BOOKS!

"How to Read Radio Diagrams and Symbols" and "How to Make Money in Radio, Electronics and Television." Immense, practical value to you — and they're yours FREE!

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For the RECORD.

BY THE EDITOR

DEBUNKING THE POSTWAR RADIO

"WARTIME developments in radio-electronic equipment for our armed forces have all been incorporated in the new postwar superdeluxodyne radios. The unsurpassed beauty and tonal quality of our Model 48 will leave you gasping for breath. The entirely new postwar circuits and components guarantee long, trouble-free performance of this sensational line of compact receivers."

The above strikes a familiar (and now sour) note to many a progressive technician. Such ballyhoo in newspaper and radio commercials following the war led customers to believe that the radio set makers had hit the jackpot on something revolutionary in design and performance. Now many dealers are faced with the problem of backing up guarantees on sets that eat up any normal profit they could make *if* these receivers were up to par . . . but are they? From many that we have checked, they are anything but modern in design and fall far short of the tonal quality promised.

Today a serviceman stands at his bench and hunts for the socket pins of a 6C4 that are buried under a rat's nest of parts and wire and finally discovers, after 15 minutes, that someone forgot to use any solder when connecting the cathode. After correcting the situation, the chassis is reinstalled into its cabinet of rare wood (rare meaning raw) and allowed to reach its operating temperature. Some local jive is tuned in and the set is allowed to remain operating just to be sure that it is in good shape for its return to the customer. In the interim, the serviceman goes on to the testing of another set—this one was made way back in 1934 and had been giving long and faithful service up to this point.

A complete diagnosis reveals that one of the r.f. tubes had, after many thousands of hours, finally gone west and that accumulated dust had interfered with proper tuning of the receiver.

In the meantime, the reception on the first set has become progressively worse. After spending a considerable amount of valuable time, it is discovered that the heat from the rectifier tube is darned near melting the can of an adjacent i.f. and causing drift due to a drastic temperature change on the plate of the trimmer. When a time sheet is tendered, the customer hits the ceiling at the hour's time charged to labor. In the case of dealers—many absorb this cost rather than lose a customer and profit goes down to a minimum.

The above case history is typical of the many sent to our desk every month by radio service technicians.

Numerous complaints are made against poor engineering on the part of many set manufacturers and servicemen are embittered toward them as they sweat over the haywire construction of many modern receivers. They point out, for example, that it takes much more time to service a postwar than a prewar receiver. Parts are unduly crowded and carelessly placed. Soldering, in many cases, is bad and, in others, there is no evidence of a complete inspection.

Strangely enough, some of the "horrible examples" are sets manufactured by long-established and highly responsible radio firms and not by little-known makers of unfamiliar brands.

As a case in point, we ran across an ultra-compact a.c.-d.c. battery portable recently that had better tone quality than several table model radios that were set up in a demonstration room. We were intrigued with this little receiver and removed the chassis from its case for further examination. It contained a minimum of parts and, while extremely compact, employed what we considered to be excellent engineering technique. Tubes were mounted where maximum ventilation could be had and tuning circuits were isolated by simple baffles. Every socket pin could be readily located and soldering was perfect. This receiver showed every evidence of what we might expect in a postwar radio. We can, therefore, well understand the enthusiasm of the dealer as he recommended this brand to prospective buyers.

Every manufacturer can spend only so much for any set if he is to sell it at a low price and make a profit. Thus, he is forced to cut corners whenever possible. But, progress is indicated by better quality merchandise at lower prices. Set manufacturers are regressing when all-important quality is sacrificed to the pinch-penny production technique and the use of 200 v. bypasses in 300 volt circuits.

As we see it then, the only remedy is to employ "common sense engineering." The proper placement of components can do much to offset frequency drift and other ailments, while a few more pennies should be spent for condensers—especially the hidden ones. .....O.R.

ALLIED'S NEW FREE 1948 RADIO CATALOG

172 VALUE-PACKED PAGES

Send for it now!

The Preferred Radio Buying Guide

It's off the press—the new 1948 ALLIED Radio Catalog! Get the Radio Buying Guide that's used by thousands of expert servicemen, engineers, soundmen, Amateurs, builders and experimenters. The new ALLIED Catalog—radio's biggest book—brings you 172 pages packed with the widest selections of the newest and finest equipment, at really low, money-saving prices! Here's everything in radio for everyone in radio: new Television and home receivers, packaged Sound Systems and P. A. equipment, latest Amateur receivers and station gear, test instruments, builders' kits, thousands of parts, tubes, tools, books—the world's largest stocks of nationally-known equipment. Take advantage of ALLIED'S speedy, expert shipment and the personal attention of seasoned old-time radio men. Get the details, too, of radio's newest and most liberal Time Payment Plan. Send today for your FREE copy of ALLIED'S newest, greatest Catalog—the preferred Radio Buying Guide!

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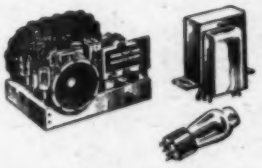

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Everything in radio for everyone in radio! Complete lines of all leading makes of parts and equipment—all from one great, centralized source. For newest developments and best values, see your ALLIED Catalog.

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A special selection of outstanding models—table radios, consoles, combinations, FM-AM—*plus* new Television, offered first by ALLIED at real savings. Hand-picked models—the choice of experts!

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Packaged, ready-to-use Sound Systems; amplifiers *guaranteed for one full year*; everything in speakers, microphones, P. A. accessories, intercom and recording equipment—leading headquarters for Soundmen!

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R-1253 Walnut
R-1254 Mahogany

A Masterpiece in design and engineering

The Newest DELCO RADIO Combination

SPECIFICATIONS

CIRCUIT: Eleven tube plus rectifier superheterodyne, AM and FM reception; Short Wave Band 5.8 to 18 megacycles. Operates on 105-125 Volt 60 cycle alternating current.

TUNING: Automatic push-button; separate sets of five push buttons each for AM and FM.

CONTROLS: On lower section of instrument panel—Volume, Tone, Band Selector, Phonograph, On-and-Off Switch.

DIAL: Etched glass, edge-lighted.

AUDIO: Push-pull beam power output; 12-inch, permanent-magnet speaker.

ANTENNA: Separate, built-in for AM and FM. Terminals for use with outside dipole antenna on FM and Short Wave Bands.

RECORD CHANGER: Automatic operation, for fourteen 10-inch or ten 12-inch records. Balanced tone arm for true record reproduction.

This radio was designed and executed for those who respond to fine furniture as they do to fine music . . . it was created *by* experts *for* experts.

In this newest Delco there is no skimping of materials, no cutting of corners. An AM-FM-SHORT WAVE high-fidelity radio, with push-button tuning for both AM and FM, is combined with phono-reproducing equipment that is the product of famous audio laboratories. Period-designed cabinets of solid, hand-rubbed walnut (or mahogany) with matching veneers.

You have to see and hear this great new Delco Combination to realize how fully it provides *the best of all that's new in radio.* Ask your United Motors Service distributor for a demonstration.

UNITED SERVICE MOTORS

DELCO RADIO

A GENERAL MOTORS PRODUCT

Delco radios are distributed nationally by United Motors Service. See your United Motors distributor about the Delco Radio line.

Typical Motorola FM two-way radiotelephone receiver utilizing *Sealed in Steel* Chicago Transformers.

With *CT's* Famous *Sealed in Steel* Construction

The clean, streamlined appearance and compactness of CT's new *Sealed in Steel* construction contribute immeasurably to the trim, precision-like effect of any electronic equipment.

In addition, CT Transformers provide "steel wall" protection against atmospheric moisture, efficient magnetic and electro-static shielding, unsurpassed strength and rigidity to withstand shock and vibration, and unusual convenience of mounting.

Two base styles are available for most of the units in this catalog line, one with clearly identified solder lugs in a phenolic terminal board, the other with RMA color coded leads, stripped and tinned for easy soldering.

The design of these new power transformers assures maximum performance with minimum physical size and minimum temperature rise in accordance with RMA standards.

The wide range of carefully selected ratings achieves maximum flexibility of application, close matching with today's preferred types of tubes, and conformance with all industry standards.

Write direct for catalog illustrating, describing and listing the complete line, or contact your nearest radio parts jobber at once.

PLATE AND FILAMENT SUPPLY TRANSFORMERS

Primary 117 Volts, 50-60 Cycles

Catalog Number	HIGH VOLTAGE SECONDARY A.C. Volts	D.C. Ma.	D.C. Volts Output	FILAMENTS Rectifier Volts	Amps.	No. 1 Volts	Amps.	No. 2 Volts	Amps.
For CAPACITOR INPUT SYSTEMS									
PC-55	270-0-270	55	260	5	2	6.3CT 2	.....		
PC-70	335-0-335	70	320	5	2	6.3CT 3	.....		
PC-85	330-0-330	85	320	5	2	6.3CT 3	.....		
PC-105	345-0-345	105	320	5	2	6.3CT 3.5	.....		
PC-120	375-0-375	120	380	5	3	6.3CT 4	.....		
PC-150	370-0-370	150	390	5	3	6.3CT 4		6.3CT 1	
PC-200	385-0-385	200	390	5	3	6.3CT 4.5		6.3CT 1	
For REACTOR INPUT SYSTEMS									
PR-55	350-0-350	55	260	5	2	6.3CT 2	.....		
PR-70	425-0-425	70	320	5	2	6.3CT 3	.....		
PR-85	440-0-440	85	325	5	2	6.3CT 3	.....		
PR-105	445-0-445	105	325	5	2	6.3CT 3.5	.....		
PR-120	500-0-500	120	400	5	3	6.3CT 4	.....		
PR-150	505-0-505	150	400	5	3	6.3CT 4		6.3CT 1	
PR-200	520-0-520	200	410	5	3	6.3CT 4.5		6.3CT 1	
PR-300	550-370-75-0 -75-370-550	300	425	5	6	6.3CT 5		6.3CT 1	

Also available in the *Sealed in Steel* constructions:

FILTER REACTORS with current ratings to match power transformers above.

FILAMENT TRANSFORMERS to meet a wide range of modern tube requirements.

AUDIO TRANSFORMERS—Input, Output, Driver, and Modulation—that provide uniformly high fidelity response in three frequency ranges: 30-15,000 cycles, 50-10,000 cycles, and 200-3,500 cycles.

CHICAGO TRANSFORMER

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They keep pace with the manufacturers' releases

A Few of the Thousands of Great Money-Saving Buys in this 160-Page Catalog!

Combination Wire Recorder-Disc Phono Unit

A basic unit around which the builder, amateur or experimenter may build a complete unit for magnetic wire recording and playback, as well as standard disc phono playback. You may use it to record events, speech or music for reference at any future time, or you may ERASE all sound from the wire and RE-record, as many times as you wish, on the same wire. The wire recorder uses standard spools of steel recording wire (not supplied, see list below). Measures 13x8x7¾". Requires area 15½x12¼" for playing 12" disc records. Complete with oscillator coil, circuit diagrams and instructions for building four tube amplifier and erase and bias oscillators.

C22522..... **$47.95**

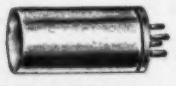
C16311—15 min. spool..$1.75 C16312—30 min. spool..$2.55 C16313—60 min. spool..$4.20

New 3-Way Portable

Changes From Battery to AC-DC Automatically

No special switches on this modern portable, plug it into a wall socket for AC-DC operation—pull out plug—Presto—it's battery operated! Weighs only 6 lbs. Size 8¼x6x5¼". Has 4 tubes plus rectifier. Case is covered with beautiful two-tone simulated leatherette. Choice of blue and white, red and white or green and white. State color, less batteries.

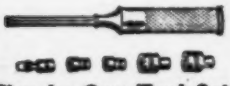
1-518 Each, in lots of 3....$17.95
Each, in single lots..$18.95
C19882 Battery Kit.....$ 2.79



6 Volt Vibrator

Replaces Mallory 294, 4-4, Radiart 5300, 80-1, Utah NP-42, Delco 5,040,000, 5,052,378, Meissner EO1.

SB3950..... **$1.05**



Five-in-One Tool Set

Cadmium-plated steel shank and knurled handle, hollow to store five snap-on tips. End of handle unscrews to remove tools. Tips are: ¼x¾" screwdriver and ⅜", ⅜", 7/16", and ½" socket wrenches. 7¼" long. Wt., 2 lbs.

SB6985—
Your Cost..... **79c**

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12 Tools Telescope into 5 Units

This kit is composed of alligator side wrench, 6" insulated driver—metal nib, 5/16" and ¼" nut wrench, ¼" insulated square nut wrench, ¼" hex metal side wrench, 2½" insulated driver with metal nib, ¼" hex slotted insulated wrench driver, 5/16" hex insulated nut wrench, 5" and 6" insulated driver.

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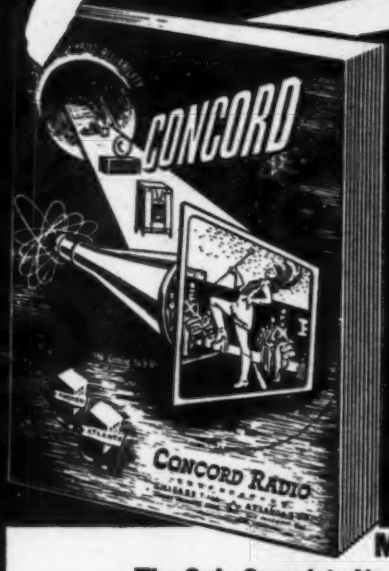

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1. Impervious to moisture	Ceramic-X is non-hygroscopic. Moisture absorption is .007% or less.	No deterioration, no shorting. Longer life even under the most adverse conditions.
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Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By FRED HAMLIN
Washington Editor, RADIO NEWS

AS WE PREDICTED in January, Wayne Coy is the new chairman of the Federal Communications Commission. (Actually, we mentioned his name among a number of others as a possible candidate, but no Washington correspondent worth his salt remembers his mistakes, and all go to great pains to display their prophetic abilities.) Anyhow, Mr. Coy, a former fiscal expert in the Roosevelt regime and more recently manager of the Washington, D.C., station WINX, has taken over the job made vacant by hard-working Charles R. Denny last fall.

WE HAVE INQUIRED around since Mr. Coy took the new post, and reports are that the choice, so far, is considered good both in and outside FCC. The new chairman moved in fast and showed signs of being not only very active at hearings, but knowing what he's talking about, both from the radio standpoint and the legal. "He's showing signs of being a harder worker than Denny," are the words of one FCC observer, and a number of industry and broadcasting sources, while still keeping their fingers crossed, are equally pleased. Whether Mr. Coy will continue in the good graces of all concerned after his honeymoon on the new job is over is anybody's guess, but at least he is off to a good start.

SO, ALSO, ARE 1948 television activities. Indeed, they are going so fast that it's difficult to keep up with them. Applications for broadcasting television are pouring into FCC at a great rate, with the tide not yet at peak. On a single day recently, eleven applications came in for television stations. Biggest interest as this goes to press is in Ohio, where town after town has asked for a license, but other areas show signs of being equally strong as the year goes forward. Those already in the field are also piling up new records. The number of television sets and viewers, according to a recent NBC progress report, shows set ownership up from 6500 in metropolitan areas on December 31, 1946, to 65,000 as of October 1, 1947—which does not, of course, include the large number of sales not yet tabulated completely, made during the Christmas season. Figuring six viewers per set, the NBC estimates that television reached at least an audience of 600,000 by the end of 1947, and that this audience will be up to some 2,400,000 by the end of 1948.

NOT TO BE UNDERESTIMATED in the 1948 radio derby is another new development that shows signs of going to town much sooner than was expected, despite half a dozen obstacles that still stand in the way. This is facsimile broadcasting of newspapers. Still technically in the experimental stage, it is nevertheless working on a practical basis—and working well. *The Philadelphia Inquirer* is already broadcasting the news—with pictures—and as this went to press a number of other papers were ready to go, including *The Miami Herald* and *The New York Times*. Obstacles in the way of mass development are numerous. A receiver costs from $600 to $900—not exactly a modest down payment for you to make to get your morning newspaper. Broadcasters also have to ante up considerable—$10,000 to $15,000 to convert to facsimile. But there are assets—FM has been effective poison to bugs that used to crop up in facsimile when AM rumpled the news pages with static and newspapers are showing a lively interest in getting a running jump into the field. Don't expect it tomorrow—but, to summarize, don't be surprised within the next five years if you wake up in the morning with an 8½ x 11 inch newspaper on the floor beside you, fresh off the air.

ONE HOT POTATO that lit in the FCC lap early this year has cooled until, at writing, you can carry it around without asbestos gloves. That is the long-standing battle between FM stations—now represented by the Frequency Modulation Association—and the *American Telephone and Telegraph Company*, which controls the growing network of coaxial cables up and down the land. It's a complicated story at best, and after the contending lawyers got through with it, it often made more sense read backward than forward, but a nutshell summary may help. FCC granted *AT&T* experimental rights on the coaxial some time ago. *AT&T* used the coax to pipe television to and from Washington and New York. Television got the coax right for free, although

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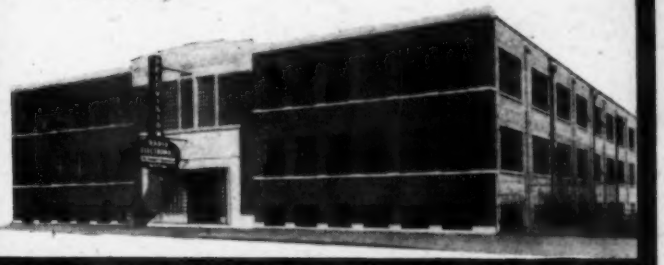

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more recently television programs have been piped containing advertising. Comes FM, wanting hook-ups via coax over the same route. *AT&T* says no. FM goes to FCC and asks why not. FCC says, why don't all concerned get together and talk it over? . . . Well, this happened in an informal conference in Washington recently, and the FM-*AT&T* representatives revealed two things—that they had not tried too hard to get together and that, differences considered, they got along pretty well. FM wants a 15,000-cycle circuit operation, and a formal request for it was made at the suggestion of the Commission after the meeting. This was on its way to FCC as we went to press. *AT&T* says that they can convert to FM service with proper terminal facilities, but do not want to do any expensive converting without some assurance that FM will use the service permanently. The whole matter was left on an experimental basis for the present, but every indication is that all parties involved will get together and work out a permanent solution.

THE FMA, incidentally, is still bursting with optimism and predictions that the new field will offer thousands of jobs to young men and women in the immediate future. New stations, the Association reports, will go on the air at the rate of 50 a month during 1948. According to Thomas F. McNulty, FM treasurer and chairman of the FMA liaison committee to the RMA, more than 380 FM commercial stations are now operating, as compared to 136 in January 1947, and 630 more have been authorized for construction this year by the FCC.

ON THE JOB END of the business, another FM spokesman, J. N. (Bill) Bailey, executive director of the FM Association, is equally sanguine. "The door stands wide open," he points out, "to young men and women who want to carve a career for themselves in radio." New stations on the FM circuit will offer numerous opportunities, Mr. Bailey believes, and a full share of these will appear during 1948. "This year will see the greatest expansion FM has known," he predicts, and there will be jobs accordingly all along the line, both for broadcasting talent and for technicians. We should emphasize—as we have before—that the best way to go after these jobs is neither through Mr. Bailey nor us. We do not run FM stations. See the man who owns one or—perhaps better—the man who's about to open one.

WITH 1947 TRANSMITTER SALES totalling around the hundred million mark and with receiver production and sale at an all-time high, far-seeing Radio Manufacturers Association is putting more and more emphasis on another war-neglected

(*Continued on page* 183)

This amazing WARD aerial sells FM better than 10,000 words!

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It's easy to install . . . no complicated orienting required.

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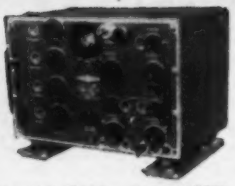

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Four separate output tanks.

One 4 position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11x12x15 inches, weight 35¼ lbs. Complete, simple instructions for conversion furnished. Complete with tubes..... **$49.95**

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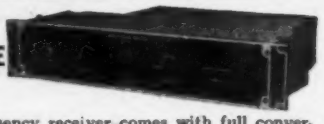

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Extra set of coils..... $2.95

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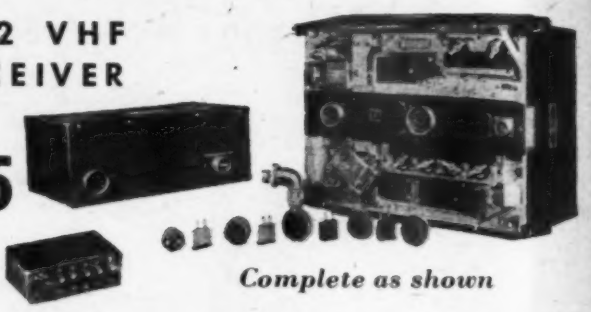

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414	423	431	440	447	459	472	483	492	501	508	519
415	424	433	441	448	462	473	484	493	502	509	522
416	425	434	442	451	463	474	485	494	503	511	523
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49c each

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BC-684FM 35 WATT TRANSMITTER

These units are BRAND NEW, providing 35-watt output, 10 channel push button crystal control employing NONLINEAR MODULATING COIL. This unit tunes from 27 to 38.9 mc. These units come complete with tubes less power supply, covers, and crystals. Excellent 10 meter FM transmitter for "Ham" or police use..... **$24.95**

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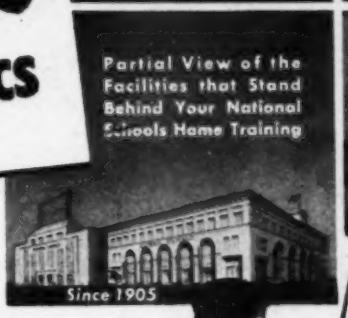

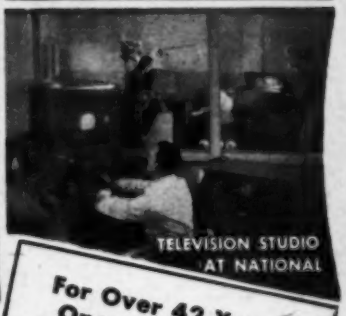
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NATIONAL SCHOOLS SHOP METHOD HOME TRAINING WILL START YOU RIGHT

We will train you today to get started tomorrow in one of the thousands of opportunities opening in the field of Radio, Television and Electronics. The Home Radio Service Field continues to grow. **Television is here** . . . Television Broadcasting facilities are being rapidly expanded. Television sales, service, installation and maintenance requirements are more and more important from day to day. **Electronics is an important factor** in many applications for utility, safety, accuracy and convenience. **Airlines** are finding new uses for Radio bringing new benefits to air transportation. **Ships at sea** are employing Radar together with other conventional Radio apparatus for ship-to-shore communications and safety. **Frequency Modulation** is modernizing Radio Broadcasting, offering static-and-interference-free reception in the home. **The list of Radio applications is almost endless,** and every one represents increasing opportunities in our modern world for the **RADIO, TELEVISION AND ELECTRONICS TECHNICIAN WITH A SOLID TECHNICAL BACKGROUND.**

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It is not a question of opportunity but rather how to take advantage of existing opportunity. Only proper training can make these opportunities a **reality.** National Schools of Los Angeles, one of the oldest and largest technical trade schools in the United States, **offers you Shop Method Home Training, a proved method that builds qualified technicians.** Here is Home Training that BRINGS RESULTS.

Behind all training from National Schools stands a permanent faculty of experienced instructors and engineers. These men are daily teaching resident students right in our own Shops and Laboratories. From first hand experience with students here at school, our instructors understand the needs and ambitions of men like you. All of our instructors, both Home Study and Resident, have ideal facilities to make your training practical, up-to-the-minute, interesting. It takes years of experience to know how to train men, especially in the practical technical trades. Established almost 50 years ago, National Schools has a rich background of experience to help you to take full advantage of the opportunities in the Radio, Television and Electronics Industry.

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4. How to Test Speaker in Audio Stages.
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6. Complete Reference Table for Quickly Locating Receiver Troubles.

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This versatile testing instrument is portable and complete with test leads and batteries. Simple to operate, accurate and dependable. You will be able to quickly locate trouble and adjust the most delicate circuits. You can use the Multitester at home or on service calls. It is designed to measure AC and DC volts, current, resistance and decibels. You will be proud to own and use this valuable professional instrument.

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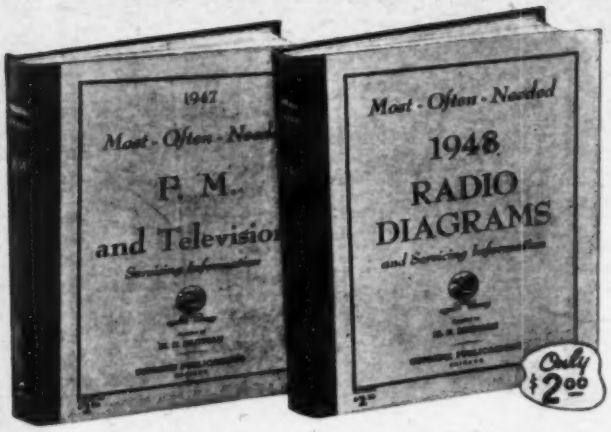

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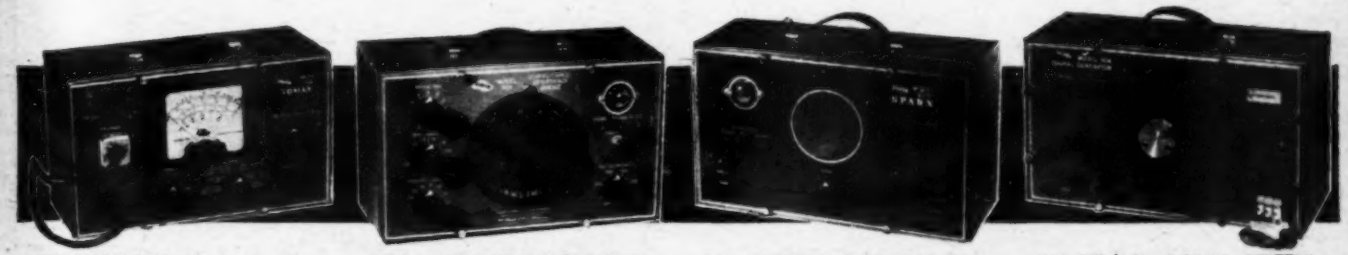

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FM-AM CHASSIS

Standard broadcast and new FM Band. Has 10 tubes plus rectifier, automatic volume control and input for phonograph. 10" Alnico V speaker, built-in antenna for AM and folded dipole for FM reception. AC. Size: 13¾" x 9" x 8⅞".

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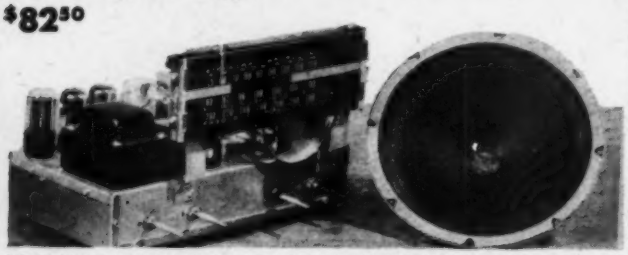

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Ideal for "remote" areas. Standard broadcast band, Push pull audio — 3 watts undistorted output, variable tone control, Phono input. Uses 2/25L6 1/6SL7G 1/6SF7 1/6SA7 2/25Z6. Inverse feedback and automatic volume control. AC-DC. Size: 11" x 5¼" x 5½". *Complete with 7 tubes and 10 inch speaker, loop antenna.*

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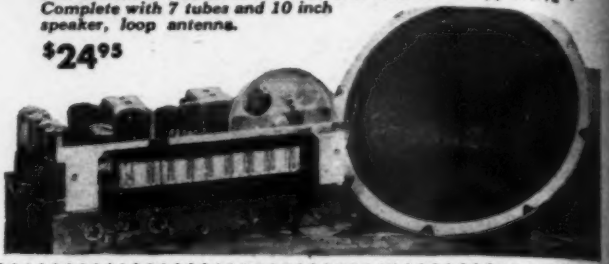

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Combination Wire Recorder and Record Player

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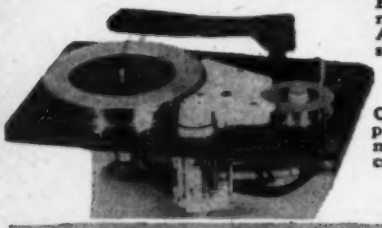

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Complete recorder with amplifier. Speaker microphone mounted in portable carrying case,

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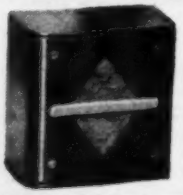
2-way system, master & sub in beautiful black plastic with 50 feet of cable. Has 4" PM speaker and 3 tube amplifier. Operates on 105 to 125 volts — AC-DC. Easy to install and economic to operate!



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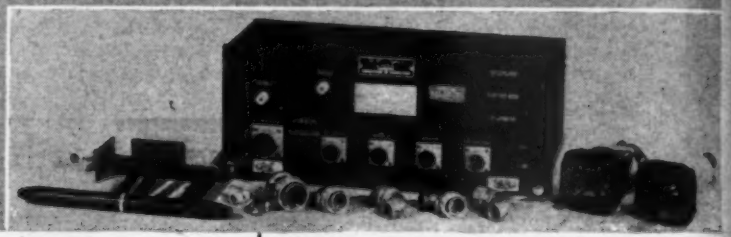

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For Transmitters or Public Address Outfits; Mobile or Yacht Installations. Output—500 Volts at 200 MA Continuous or 400 MA Intermittent. Input — 12 or 24 Volts DC. Made by the Rauland Corp., Type DM-40AX. Price, **$5.95**

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CONDENSERS

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999	Aerovox .05 mfd. 7500 volts	$.98	.75
1002	Pyronol G.E. .01-5000 volts	$.50	.45
2006	Bathtub .15 mfd.-600 volts	$.16	.13
2007	Bathtub 2 x .1 mfd.-600 volts	$.16	.13
2008	Bathtub 2 mfd.-400 volts	$.22	.18
2009	G.E. upright .5 mfd-600 volts	$.16	.13
2010	Bathtub .01 mfd.-600 volts	$.16	.13
2011	Bathtub 1. mfd.-400 volts	$.20	.16
	PAPER TUBULAR		
2000	.1-200 volts	$.06	.05
2001	.01-400 volts	$.06	.05
2002	.02-200 volts	$.05	.04
2003	.001-600 volts	$.06	.05
	DRY ELECTROLYTIC TUBULAR		
2004	4 mfd.-150 volts	$.20	.16
	MICA CONDENSER		
2005	.03-2000 volts	$.30	.25

OUTPUT TRANSFORMERS

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2015	Universal, will match any single or push-pull tubes, strap mounting, size 2" x 2⅛" mtg. centers.. $.65
2013	Single 7000-9000 ohm to 4. ohms v.c. $.50
2014	Single 50L6 output to 3.2 ohm v.c. $.30

15" HIGH-FIDELITY DYNAMIC SPEAKER

Husky 25-watt dynamic speaker for use where perfect reproduction is desired. Ideal for both indoor and outdoor installations. 12,500 ohm field, 16 ohm voice coil. Regular $40.00 list. **$18.95**

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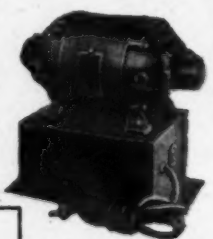

Operate your AC Receiver, Record Player, Combination, etc., from DC line. Output—110 Volts, 60 cycle, single phase. Input—115 Volts DC, .125 KVA at 2 Amp. Made by Electric Specialty. Includes built-in filter. New; individually crated. Limited quantity.

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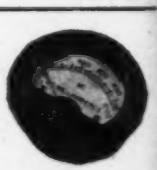
Stock #1000

5" DYNAMIC SPEAKER

5" Dynamic Speaker—450 ohm field coil—output transformer for .50L6.....$1.40

Stock #1020

METER 3" 0-10 MA—Scale reading, 0 to 1 M, made by De Jur Amsco. Price, each, **$1.95**



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Within the INDUSTRY

MICHAEL SCOTT, formerly vice-president and general manager of *Radio Wire Television, Inc.* of Boston, has been named sales manager of communications equipment division of the *Hallicrafters Co.* of Chicago.

Mr. Scott, who has been associated with the radio industry since 1926, served as officer in charge of the electronics division of the Navy disposal administration during the war. As president of the Yankee Chapter of the National Electronic Distributors Association (NEDA) he has been active in merchandising circles in New England.

He joined *Radio Wire Television, Inc.* in 1934 and served as New England chief of the WPA's radio-radar division.

* * *

ROBERT M. KARET has announced the formation of *R. M. Karet Associates, Inc.*, a firm of manufacturers' representatives with offices at 510 North Dearborn Street in Chicago.

Mr. Karet was formerly sales manager of the *Thordarson - Meissner-Radiart Division* of *Maguire Industries* and prior to that was, for many years, sales manager of the jobber division of the *Utah Products Company.*

John S. Margolin, formerly with *Stromberg-Carlson,* is vice-president of the new organization.

The company has been appointed to represent *Pilot Radio Corporation* in the states of Michigan, Indiana, Illinois, Missouri, Iowa, Wisconsin, Minnesota, North and South Dakota, Nebraska, and Kansas. The company is maintaining resident sales offices in St. Louis and Minneapolis in addition to the main office in Chicago.

* * *

CARL A. STONE, veteran manufacturers' representative, has been named president of the Los Angeles chapter of the Representative of Radio Parts Manufacturers, Inc. for the coming year.

Serving with Mr. Stone are Gerald B. Miller who was named vice-president, and M. D. Faly who was re-elected to the post of secretary-treasurer. Mr. Stone and Mr. Miller succeed Dave Marshank and George Tivy, respectively.

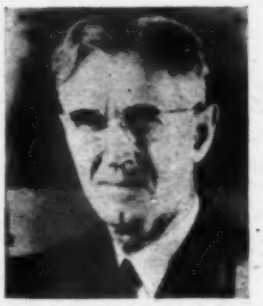
* * *

OHMEGA LABORATORIES, INC. is the name of a new corporation recently formed to specialize in research, design, and development of all types of electronic and associated equipment.

E. E. Crump, formerly of *Bell Telephone Laboratories,* is the president of the new company, while L. L. Libby, who was formerly associated with *Federal Telecommunications Laboratories,* is the chief engineer.

The new corporation is an out-

FRANK E. BUTLER, well-known inventor, educator, and author, passed away recently in his home in Toledo, Ohio. One of RADIO NEWS' best-liked authors, Mr. Butler, was born in Monroeville, Ohio, only a few miles from the birthplace of Thomas A. Edison. Like Edison he started his career as a telegraph operator from the same location and at the same age, 15 years. On June 10, 1904, he resigned as a train dispatcher for the New York Central to become associated with Dr. Lee de Forest and for many years acted as his chief assistant. During this time Mr. Butler was in charge of constructing high-powered wireless stations at Pensacola; Key West; Guantanamo, Cuba; Colon, Panama; and San Juan, Puerto Rico. He then went to Manhattan Beach, Long Island, where he erected a station and sent the first wireless messages across the Atlantic. In the summer of 1906 when Dr. de Forest left American Wireless Telegraph Co., Mr. Butler also left, and in a little laboratory in the Parker Building, New York City, they worked together in developing the Audion tube. In 1908, Mr. Butler organized The American Wireless Institute, the first school in the world to teach wireless engineering. He designed numerous early radio circuits; and was sales manager of several tube companies, among them Archatron, Volutron, Arcturus, and Ken-Rad. At the time of his death, he was writing for several technical publications and was the author of books dealing with the progress of wireless, radio, and electronics. His latest and most important book, which was nearing completion, is an autobiography relating hitherto unknown facts about the birth of radio.



growth of *Kay Electric Company* of Pine Brook, New Jersey, makers of the "Mega-Sweep" sweeping oscillator and the "Mega Match." *Kay Electric Company* will relinquish all its specialized development work to the *Ohmega Laboratories* and concentrate of manufacturing of instruments for electronic measurements. The *Ohmega Laboratories, Inc.* will also be located at Pine Brook, New Jersey.

* * *

V. M. GRAHAM, director of technical relations for *Sylvania Electric Products Inc.* of Flushing, New York, has been elected chairman of the Joint Electron Tube Engineering Council which is sponsored by the Radio Manufacturers Association and the National Electrical Manufacturing Association. The Council was established in 1944 to standardize data and engineering practice for electron tubes.

The Council includes two directors, one from RMA and the other from NEMA, and six members representing tube manufacturers. JETEC was organized largely through the efforts of Dr. W. R. G. Baker of *General Electric;* A. C. Streamer of *Westinghouse Electric;* and O. W. Pike of *General Electric,* the retiring chairman. The Council operates through several line committees concerned with various classes of electron tubes commonly used in radio and industrial electronic applications.

Mr. Graham has been active in the Engineering Department of the RMA and has served as an associate director of that department for twelve years. He is a Fellow and Director of the IRE and has been chairman of the IRE-RMA Rochester Fall Meeting Committee since 1929.

* * *

ROBERT A. ELLIOT, supervisor of export sales of broadcast audio equipment for the *RCA International Division,* has been named manager of broadcast audio sales for the company's domestic division.

In his new position, Mr. Elliot will direct national sales of *RCA's* complete line of broadcast audio equipment.

Mr. Elliot joined the *International Division* of *Radio Corporation of America* in 1945 and acquired extensive sales engineering experience installing broadcast equipment in many parts of the world. During the war he was in charge of studio engineering for the Radio Section of the Office of War Information.

He joined the *National Broadcasting Company* in 1933 and after five

(*Continued on page* 116)

Are the New SPRAGUE TM's *REALLY BETTER?*

you be the judge—TRY THEM IN YOUR TOUGHEST JOBS

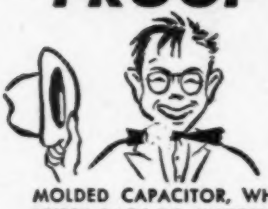
We think the new Sprague type TM *molded* paper tubular capacitors are so far ahead of any other capacitors that there just isn't any comparison.

Quite naturally, we should! Not only do we make them . . . we know *how* they are made and *why* they are better.

But don't take our word for it. If you haven't already seen and used these new units, by all means get at least a few today. Try them in your toughest jobs—auto radios that get hot and are subjected to severe mechanical shocks. Use them in portable sets and in some of those small ac-dc radios that operate at temperatures at which you normally fry eggs. Give them the kind of jobs to do that are tough on paper tubulars. Then check for performance and long life.

All we ask is that you *try* them. If you don't decide the new Sprague Molded TM's are better than any other paper tubular capacitor you have ever used, we don't want to try to convince you! We feel confident of the result because we know that *your reputation* and *your customers deserve the best!*

"PROOF POSITIVE!" by Prof. Squeegee



Professor Oswald Z. Squeegee, the man who first successfully smashed the Atom in Sprague advertising back in 1938, took time out from his secret studies to wire:

HAVE JUST COMPLETED SEVERE LABORATORY TEST OF NEW SPRAGUE TM. SOAKED IT ONE WEEK IN SALINE SOLUTION (FISH BOWL, TO BE SPECIFIC). MIXED CONTENTS INCLUDING FISH AND SPRAGUE TM WITH ONE CAN DOG FOOD. HEATED TO 85° C. FOR THREE HOURS. DOGS ATE EVERYTHING BUT MOLDED CAPACITOR, WHICH WAS TOO HARD FOR CANINE TEETH. HATS OFF TO SPRAGUE! MUST HURRY BACK TO HISTORY-SHAKING EXPERIMENTS.

PROF. SQUEEGEE

CAPACITORS

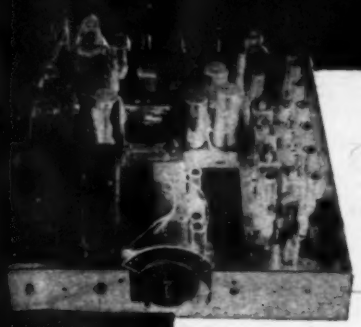
SPRAGUE

*KOOLOHM RESISTORS

*T.M. Reg. U.S. Pat. Off.

SPRAGUE PRODUCTS COMPANY, North Adams, Mass.

JOBBING DISTRIBUTING ORGANIZATION FOR PRODUCTS OF SPRAGUE ELECTRIC CO.



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Assemble the Champion model of your choice, 10" flat surface screen picture, 51 sq. in. picture, 12" screen picture with 75 sq. in. picture or the 15" screen picture with 120 sq. in. picture.

All Champion Models are complete with all tubes and components including the CR Tube.

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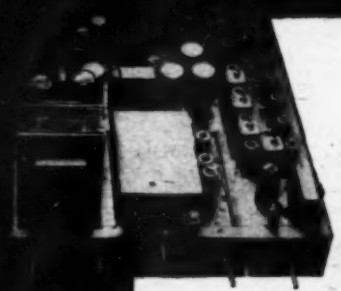

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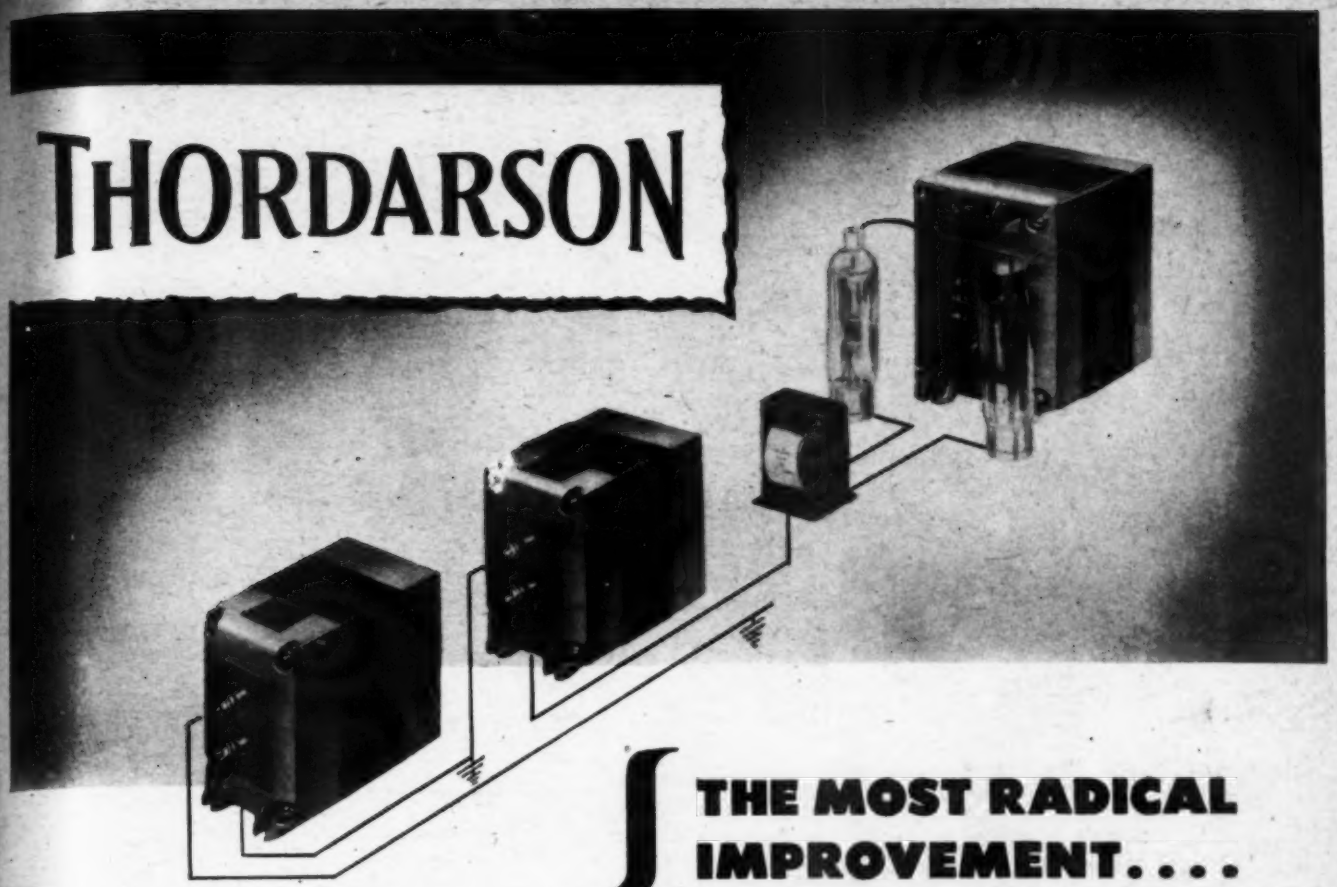

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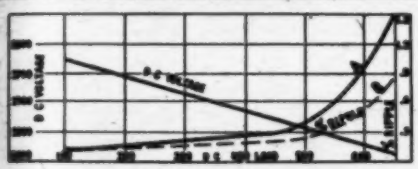

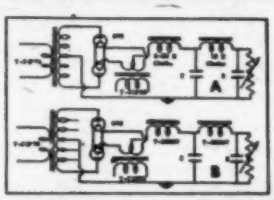

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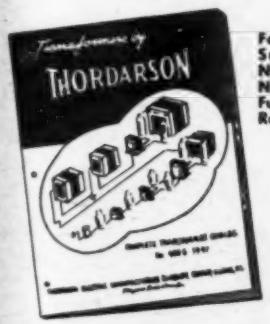

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ATOM SMASHERS

Principle of operation of modern types of particle accelerators — the Betatron, Cyclotron, and the Van de Graaff Generator

By JAMES J. TEEVAN

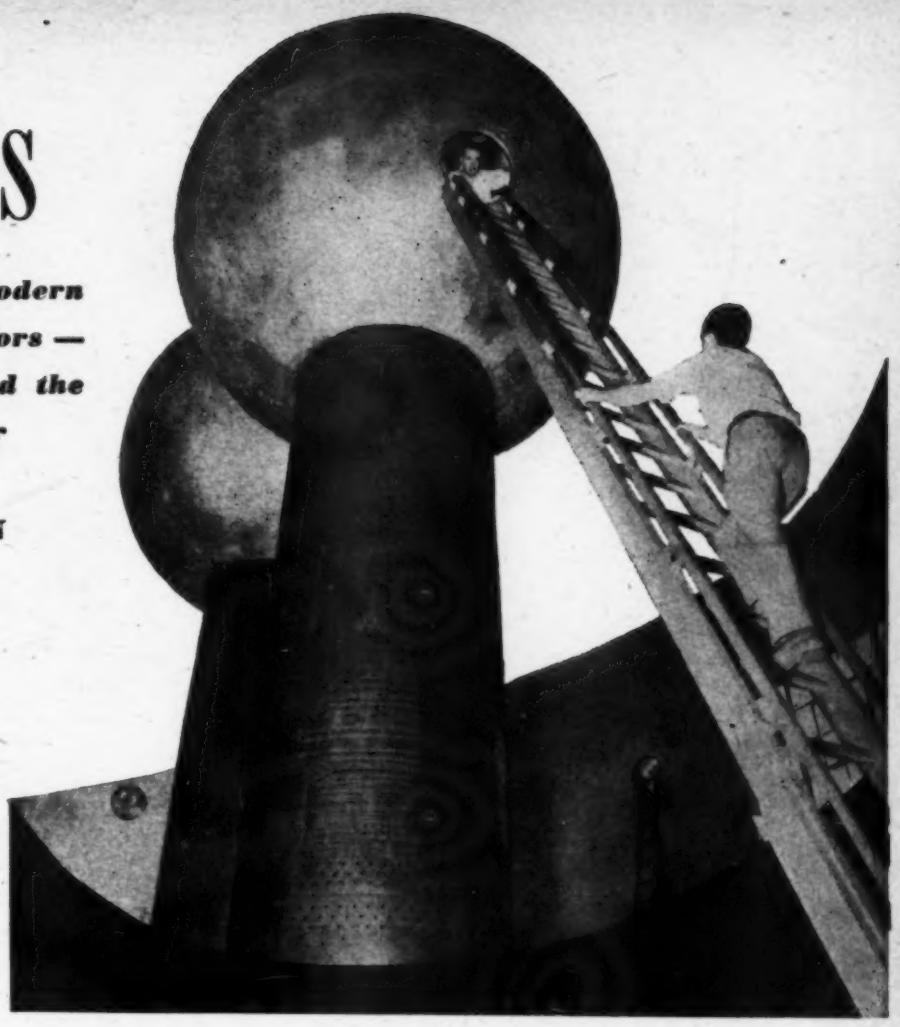


Fig. 1. The Massachusetts Institute of Technology's electrostatic generator.

THE smashing of an atom's nucleus involves a physical breaking apart or the creation of an unbalanced condition. Projectiles, be they protons, deuterons, alpha particles, positrons, or neutrons, are fired at terrific speeds at a nucleus to bring about such a condition. There is needed, then, what might be termed heavy artillery—accelerating devices that will develop extremely high voltages with a minimum of current. Scientists have at their disposal today three outstanding pieces of apparatus for just this purpose, the Van de Graaff Generator, the Cyclotron, and the Betatron. The ultimate aim in the use of each is the same, the flinging of minute particles with ever increasing energy and speed at the nucleus of the atom. It is no easy matter to score a direct hit with these pieces of artillery. Bear in mind that the largest of the atoms is about .00000001 of an inch in diameter and that in one ounce of hydrogen there are some 20,000,000,000,000,000,000,000,000 atoms. Fortunately a direct hit is not necessary. A near miss will induce within a nucleus electrical oscillations, oscillations that in most cases will disrupt the force of attraction holding together the protons within, a force billions of times more powerful than the earth's force of gravitation.

One of the earliest pieces of artillery developed for the creation of the high voltages necessary in the smashing of atoms was the Van de Graaff Generator.

The Van de Graaff electronic generator uses the principle of static electricity for the imparting of extremely high speeds to the particles or projectiles used. In general terms, the heart of the generator is composed of two endless belts, the bottoms of which are sprayed with opposite charges, the one negative and the other positive. Both belts reach up into metal spheres upon which the charges are deposited. When the accumulated charges on the spheres become great enough, in some instances as much as 5,000,000 volts, they are applied to the firing of the atomic bullets. What determines the maximum voltage that may be deposited on the spheres, which in the latest model at the Massachusetts Institute of Technology are joined, is the breakdown potential existing between the spheres and the objects surrounding them at ground potential.

Though comparatively simple in construction and operation, the Van de Graaff Generator is, to say the least, rather imposing. (See Figs. 1 and 5.) The two large hollow columns of the ten-million-volt generator at MIT are twenty-five feet high and six feet in diameter. The hollow polished aluminum sphere that surrounds the columns measures some fifteen feet across the center. The aluminum spheres, which act as reservoirs for the charge, are forty-three feet above the ground. Weighing a ton and a half each, the spheres are polished to a bright finish to eliminate projections that might cause sparking.

The wide, fast-moving belts within the columns may be either of silk or paper. Metal combs take the charges off the belts and transfer them to the outside surface of the spheres. As more and more charge is sprayed on the belts and carried up, the potential of the individual spheres naturally increases. The potential having been raised to the desired amount, the ions produced at the positive sphere are fed into a discharge tube. Low pressure gas within the discharge tube produces further ions and from there they are shot into the accelerating tube. On their way through the accelerating tube the ions are compelled to move along lines of force created by cylinders. Effective focusing action narrows the beam of ions to a cross section of no more than half an inch.

To all purposes, the accelerating tube might be called the barrel of the atomic cannon under consideration. The ionized bullets pick up speed as they pass through it, traveling between 30,000,000 and 100,000,000 miles an hour. The structure of this tube (Fig. 4) should prove of interest. It is composed primarily of tubular "doughnuts" connected to metallic cylinders. A corona discharge is carried from doughnut to doughnut creating a uniform voltage gradient along the length of the tube. This difference of potential between the doughnuts is usually several hundred thousand

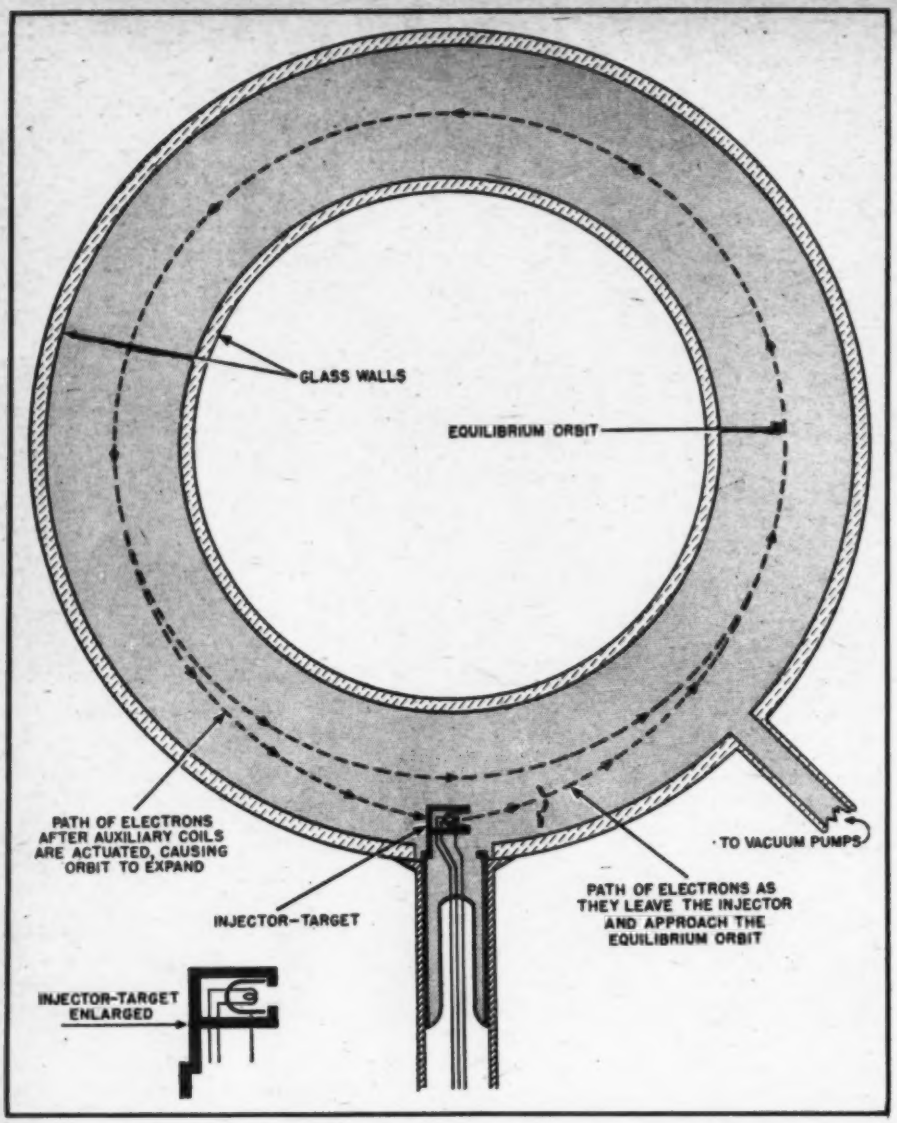


Fig. 2. A cross-sectional view of the Betatron "doughnut."

volts. The metallic cylinders act as so many lenses for the purpose of focusing the ions into the narrow beam already mentioned. As the ions move down through the tube past the cylinders they gain in energy in an amount that is proportional to the potential difference existing between the cylinders. As the ions gain in energy there is a corresponding gain in velocity ($K.E. = 1/2\ mv^2$), the effect desired for the smashing of the target placed at the bottom of the tube . . . an atomic nucleus. A magnet at the lower end of the tube sorts the projectiles according to their velocities and thus different beams of varying energy content are made available. Geiger counters and Wilson cloud chambers are then used to determine the results of these bombardments.

As the beam passes through the accelerating tube it is composed of two distinct types of missiles. The one is composed of single particles and the other of dumbbell-shaped double particles. It was mentioned above that a gas is fed into the discharge tube under a constant pressure. If this gas were hydrogen, the single particles would be protons while the dumbbell-shaped double particles would be hydrogen ions. Both types would, of course, be positive in nature and the kinetic energy received by each in its passage through the tube would be of an equal amount.

The accelerating tube of the *Westinghouse* generator has an outside diameter of 17 inches and can be so completely exhausted that it contains only one seven-hundred-and-sixty millionths as many air molecules as in the normal atmosphere. Fitted with 130 electrodes, it is completely surrounded and sealed by 132 porcelain disc insulators. To prevent the premature escape of the electrical charge the tube is surrounded by a wall of compressed air, held at a pressure of 85 pounds per square inch. The air serves as an insulator and makes possible the 5,000,000 volt charges at one microampere of direct current.

The Betatron, developed by Donald W. Kerst of the University of Illinois, in some ways resembles a Cyclotron. Designed to impart high speed to electrons or Beta rays at comparatively low voltages, it is also known as an "Induction Electron Accelerator." In function very similar to an ordinary transformer, it can impart to an electron a speed associated with a voltage of from twenty to one hundred million volts. In place of a wire secondary as in the transformer, the Betatron has as its secondary an evacuated frictionless glass doughnut but the principle is the same. (See Fig. 2.) Surrounding the doughnut is a carefully designed magnetic field intended as a focusing agent. Electrons, shot into the glass doughnut by an electron gun similar to those used in beam power tubes, are acted upon by induction as current flows in the primary. The electron gun is composed of a spiral filament, a plate, and a double plated grid. The grid concentrates the electrons in the desired definite beam.

As the a.c. cycle starts across the primary, a brief pulse of electrons is shot into the doughnut. In duration this pulse lasts but a few millionths of a second. As the a.c. builds up to maximum the electrons in the glass tube secondary are accelerated, spinning around the tube several thousand times. Moving in a circle of space, the electrons are further acted upon by the focusing magnetic field. No matter how fast the electrons move this force persists, providing the electrons remain at the same radius from the cylinder. The force itself is dependent upon the magnitude and rate of change of the magnetic field immediately surrounding each electron. When another pulse is sent through auxiliary coils surrounding the magnet the electrons leave their circular orbit and spiral inward and outward. Under this new influence the electrons now crash against a target of tungsten within the doughnut. Due to the tremendous energy with which the electrons smash against the tungsten x-rays are created. The stream of penetrating x-rays passes out of the tube and may be directed at the heart of an atom.

During this process, the current in the primary continues to flow, but it is only the rise from zero to maximum that is put to use. For the remaining three-quarters of each cycle the power is stored in a bank of condensers. A generator is needed then only to make up for the losses inasmuch as the primary coils are tuned to resonance with the condenser bank.

Theoretically, if the electric field strength exerted on an electron while in the magnetic field of the Betatron is one volt per centimeter, the electron will be accelerated to 10^{15} cm. per second. In 1/1000 of a second then the electron would be accelerated beyond the velocity of light. This is impossible as the effective mass of an electron approaches infinity as its velocity approaches that of light. Thus, although the electron's velocity can never equal that of light, it can still acquire a tremendous amount of kinetic energy.

As pointed out by James Stokley in his booklet, *"Atomic Artillery,"* Dr. W. F. Westendorp of the *General*

Electric research laboratory has devised a means of saving weight in the construction of the Betatron. Dr. Westendorp has devised a method of d.c. bias. This consists in applying a d.c. potential through special coils in such a way that the zero voltage line is, in effect, shifted downwards. Then, instead of accelerating the electrons only through a quarter of a cycle, nearly a full half-cycle can be used. It has been estimated that if the 100,000,000 electron-volt Betatron had been constructed in this way, it would give radiations up to 165,000,000 electron volts with no increase in size. Biassing of this kind has been used in the 50,000,000 volt Betatron in the *General Electric* research laboratory. Although this one has only half the energy of the larger ones, it is only about one tenth their physical size.

The Cyclotron (Fig. 3), invented by Ernest O. Lawrence of the University of California, is designed to apply a moderate force to particles many times. The fundamental theory in back of the Cyclotron is: (1) that the greater the velocity of the particles, the greater the radius of their path of motion, and (2) whether the particles are moving near the center or the rim of a chamber they require the same time to complete one revolution. As to physical make-up, an electromagnet, with its pole pieces but a few inches apart, constitutes the heart of the Cyclotron. Between the pole pieces of the electromagnet there is a shallow cylindrical chamber containing two smaller semicircular chambers. These semicircular segments are known as "dees." The edges of the dees facing each other are open while each is electrically insulated from the other. A gas fed into the two semicircular chambers is ionized in the inch and a half that separates the dees. The type of gas used will, of course, determine the nature of the projectiles. A high frequency oscillator is connected to the terminals of the dees. Just what happens to the particles of energy while in the Cyclotron may be explained briefly as follows:

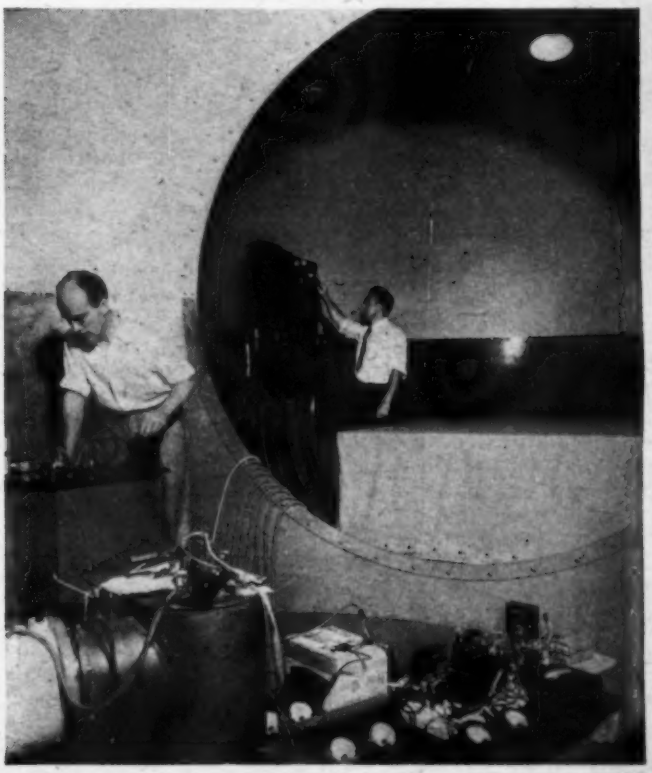
Fig. 3. The new 100 ton Cyclotron at Massachusetts Institute of Technology.

Like so many of the electronic devices with which we are more familiar, the operation of the Cyclotron originates with a heated filament. The electrons emitted hit the molecules of gas in the evacuated chamber. The positive electrified particles thus produced are then acted upon by the dees. As the oscillations occur the positive particles are first attracted to the negatively charged dee. Since

(*Continued on page* 143)

Fig. 4. A section of the 40 foot vacuum tube used in the Westinghouse atom-smasher. The o.d. of the tube is 17 inches.

Fig. 5. Inside the spherical terminals of the Van de Graaff Generator installed at Massachusetts Institute of Technology.



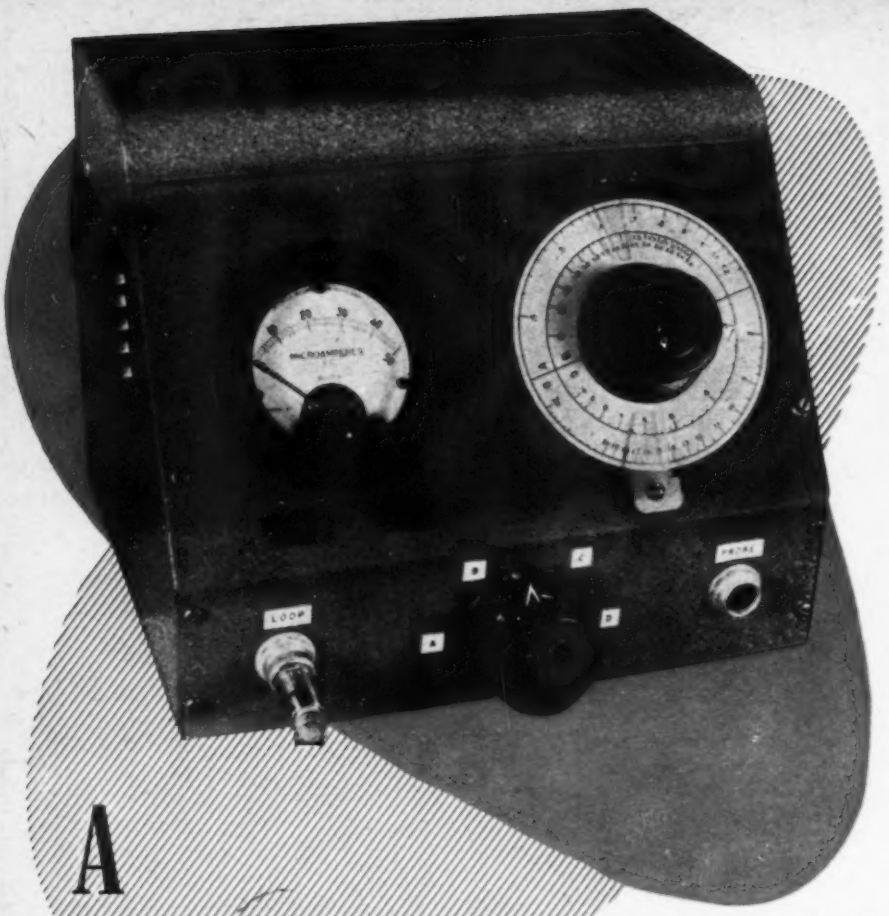


Fig. 1. External view of the instrument showing all controls and input terminals. The loop pickup cable is shown plugged into the input connector (J_2) labeled "Loop." The other connector, labeled "Probe" in lower right-hand corner of the front panel is J_1 in Fig. 6, the input jack for the exploring probe. The external meter-headphone terminals (J_3 and J_4) are the two insulated phonetip jacks seen directly below the meter. The frequency range switch (lower center in photo) is set to one of its "off" positions.

A VERSATILE SIGNAL CHECKER

By RUFUS P. TURNER, W1AY

A novel device which has much of the usefulness of the grid-dip meter, but uses no batteries or a.c. power supplies. In addition to its intended function as a line coupled wavemeter 1948 style, it may be employed as a monitor, field strength meter, radio receiver, and tuned signal tracer having a 4-band range of 400 kc. to 30 mc.

WHAT is the frequency of my crystal oscillator? Is my oscillator doubling instead of operating straightthrough? Is my doubler tripling? Is my tripler quadrupling? Is my tank tuned to the correct frequency of a 10- or 20-meter crystal? Is my v. f. oscillator running in the broadcast band instead of on 160 meters?

Each of these questions is typical of the many which may be answered quickly and simply by the time-honored absorption wavemeter. There is no need to dwell here upon the widely-known virtues of the wavemeter which have maintained the importance of this simple instrument over many years of more accurate frequency measurement.

Various operating disadvantages of the wavemeter, however, are not so well-known among experimenters and radio operators, and usually become apparent only when this instrument is used regularly. Paramount among these trying characteristics are the following: (1) The entire instrument must be poked into the transmitter or other apparatus under test in order to secure satisfactory coupling. This often is inconvenient or even impractical; (2) the wavemeter coil being of fixed size, it often is either too large or too small for satisfactory coupling; (3) separate plug-in coils or separate wavemeters are necessary if a wide frequency range is to be covered; and (4) the conventional wavemeter is useless when measurements must be made at uninterruptable circuit points where no coil can be reached for inductive coupling.

The *frequency checker* to be described in this article, while being based upon the wavemeter principle, proposes to overcome these obstacles by (1) providing for inductive coupling a series of selectable pickup rings of different diameters operated at the end of a coaxial cable; and (2) providing a shielded and isolated probe for picking up the unknown signal from a circuit point at which a coil cannot be reached conveniently for inductive coupling.

With an instrument of this type, the operator can attach to the end of the "loop cable" whichever pickup ring will give best coupling with a coil under test or which will fit best into the available space around the coil. Since the pickup ring is attached to the end of a cable of convenient length, the instrument proper may be left on the work table.

By means of the exploring probe, the operator can couple the instrument capacitively to any r.f. circuit point where no coil can be found or where the coil, when present, is concealed by other components. Shielding and a small coupling condenser minimize body capacitance and instrument capacitance effects when the probe is used.

Features of the Instrument

From the foregoing description, it is seen that the frequency checker essentially is a wavemeter which may be coupled either capacitively or inductively, through coaxial lines, to test points.

In order to cover a wide frequency range, bandswitching is employed. The single tuning dial of the instrument reads directly in megacycles. Frequency range of the checker is 400 kc. to 30 megacycles in four bands: 400 kc. to 1200 kc., 1100 kc. to 3.2 mc., 3.0 to 10 mc., and 8 to 30 mc.

Resonance is indicated by a d.c. microammeter which is actuated by a germanium crystal diode. No batteries or a.c. power supply therefore are required. The instrument has sufficient sensitivity to permit its use as a tuned signal tracer for radio receiver channel checking (resonance indications may be obtained even at

the antenna and ground terminals of the receiver), as a sensitive field strength indicator, radiotelephone monitor and carrier shift indicator, and emergency modulated signal receiver.

The instrument may be calibrated from any r.f. signal generator or serviceman's test oscillator. This is a distinct advantage, since no elaborate instruments not available to amateurs and experimenters are required.

Operating Principle

Fig. 2A is a simplified circuit of the frequency checker. The absorption wavemeter circuit is composed of coil L_2 and tuning condenser C_3. Across this tuned circuit are connected the crystal diode and d.c. microammeter in series.

The small primary coil, L_1, with its coaxial cable provides link coupling between the pickup loop or ring and the wavemeter coil, L_2. In use, a pickup ring of appropriate diameter is plugged into the end receptacle of the loop cable, the ring is inductively coupled to the proper coil in the transmitter or oscillator under test, and C_3 is tuned for maximum deflection of the microammeter.

The shielded exploring probe is employed to capacitance couple the measuring circuit (L_2-C_3) to a source of unknown signal. In use, the prod tip of the probe simply is touched to the proper point in the circuit under test, and C_3 is tuned for maximum deflection of the microammeter. When the signal strength is high, as it almost always is in transmitters, it is necessary only to point the prod tip to the circuit point in order to obtain adequate signal pickup for full-scale deflection of the meter.

Coupling condenser C_1 inside the probe handle serves also to minimize the effects of body capacitance, cable shunt capacitance, and instrument capacitance upon the device under test. Similarly; the second coupling condenser, C_2 (Fig. 2A), serves also to minimize the effect of the shunt cable capacitance upon the calibration of the tuned wavemeter circuit, L_2-C_3. By choosing both C_1 and C_2 very small, very nearly all detrimental effects due to operator, body, and instrument capacitances are eliminated.

Fig. 2B shows the relationship of the two coupling and isolating condensers and the shunt capacitance of the coaxial cable. Note that C_1, the small condenser mounted inside the probe handle, is in series with cable capacitance, C_c. The resulting capacitance looking in from the prod tip therefore is very small when C_1 is made small with respect to C_c. Actually C_c is about 40 $\mu\mu$fd, for a reasonable length of cable, and C_1 is only a few micromicrofarads. When C_1 is 4 $\mu\mu$fd., the capacitance looking into the prod tip is only approximately 3.65 $\mu\mu$fd. This total capacitance is not large enough to upset most circuits to which the tip will be touched.

Similarly; at the other end of the coaxial cable, the small condenser, C_2,

COIL	FREQUENCY RANGE	SPECIFICATIONS
A	400-1200 kc.	Primary (L_1): 15 t. #32 en. closewound on same form as L_2 and separated from grounded end of L_2 by 1/8". (See Fig 8A). Secondary (L_2): 90 t. #32 en. on 1 1/4" diam. form, closewound.
B	1100-3200 kc.	Primary (L_3): 2 t. #24 d.c.c. closewound over grounded end of L_4. (See Fig. 8B). Secondary (L_4): 56 t. #30 en. on 5/8" diam. form, closewound.
C	3-10 mc.	Primary (L_5): 2 t. #24 d.c.c. closewound over grounded end of L_6. (See Fig. 8B). Secondary (L_6): 20 t. #30 en. on 5/8" diam. form, spaced to winding length of 1 3/16".
D	8-30 mc.	Primary (L_7): 2 t. #24 d.c.c. closewound over grounded end of L_8. (See Fig. 8B). Secondary (L_8): 6 t. #24 en. on 5/8" diam. form, spaced to winding length of 5/8".

Complete details on coil construction. Coil numbers correspond to those in Fig. 6.

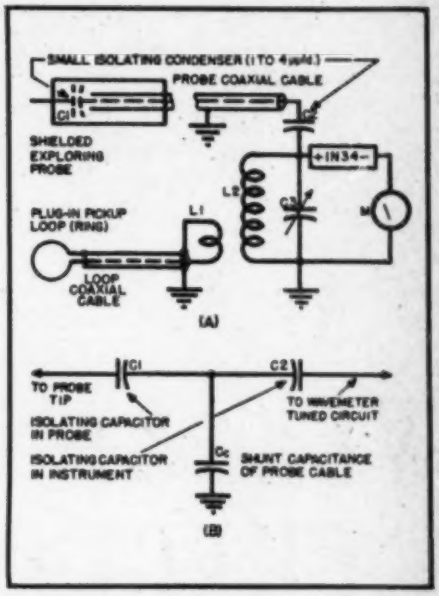
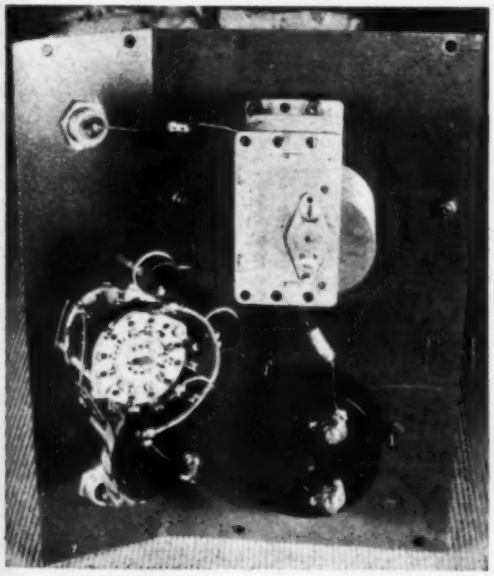
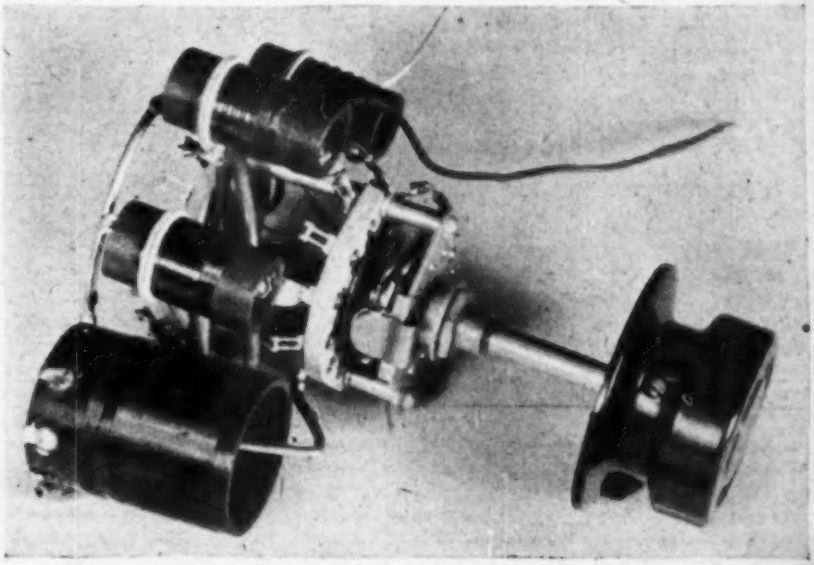


Fig. 2. (A) Basic instrument circuit. (B) Relationship between coupling condensers and capacitance of coaxial probe cable.

Fig. 3 (Left) Internal view of signal checker. Note that the crystal is hung directly between the tuning condenser and microammeter by means of the former's own long pigtails. The 4 $\mu\mu$fd. ceramic coupling condenser is similarly hung between the probe input coaxial jack and the tuning condenser stators. Fig. 4. (Right) Coil switching turrets. Coils A to D appear from bottom to top.





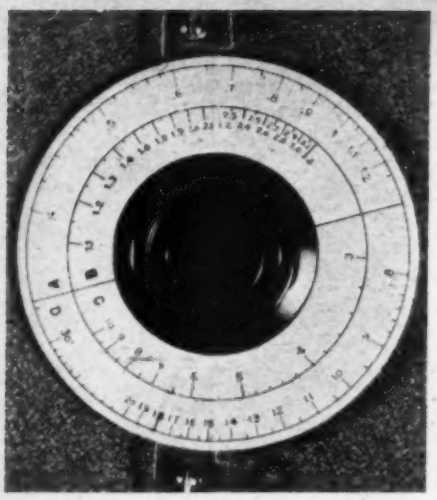


Fig. 5. Closeup of tuning dial. A standard 4" dial is used. Scales are hand-drawn on white cardboard with India ink.

is in series with the cable shunt capacitance, C_c. The capacitance introduced across the tuned circuit, L_2-C_3, by connection of the probe and its cable to the instrument, therefore is less than the small capacitance of C_3 and accordingly is not high enough to interfere seriously with the calibration of the L_2-C_3 circuit.

Since C_1 and C_2 are in series, their small total capacitance effectively isolates the wavemeter circuit from the circuit with which the probe makes contact.

By employing coil switching, any number of primary and secondary coils may be connected successively into the instrument circuit to cover a desired frequency range. The dial of the tuning condenser, C_3, may be graduated in megacycles to make the instrument direct reading.

Complete Circuit and Accessories

The complete circuit schematic of the frequency checker is given in Fig. 6. The various sections are discussed separately below.

Frequency Range Control. Switch S_1-S_2 (lower center in Fig. 1) is the bandswitch or frequency range control. One pole (S_1) switches the secondary coils L_2, L_4, L_6 and L_8. The other pole (S_2) simultaneously switches the corresponding primaries L_1, L_3, L_5, and L_7. By employing a *shorting-type* switch, as shown in Fig. 6, all unused primaries and secondaries are automatically short-circuited *and* grounded, thereby preventing their interaction with the coil set in use.

Coils and Coil Mounting. The coils L_1 to L_8 are wound in accordance with specifications given in the coil table. They are wound on bakelite or polystyrene forms, as shown in Fig. 8, and are mounted around the selector switch, S_1-S_2, by soldering to the switch. The top secondary coil lugs are soldered directly to the switch contact lugs of S_1; the bottom secondary lugs are soldered to a ring of No. 14 tinned bus wire (See Fig. 4) to connect them together for grounding. Similarly, the top primary leads are soldered directly to corresponding contact lugs of S_2; the bottom primary leads to a common lug to connect them together.

The coils are mounted in this manner to *alternate* switch contacts. This is done in order to provide ample space between coils and also to provide an *"OFF"* point (unused switch contact) between each two settings of the range switch. When S_1-S_2 is thrown to any one of these *"OFF"* positions, the coils are disconnected automatically from the crystal and meter circuit, and the microammeter then may be used externally by connecting leads to pin jacks J_3 and J_4.

Coupling Condensers. The coupling and isolating condensers, such as C_1, are miniature, zero-temperature-coefficient, insulated, ceramic units rated at 4 $\mu\mu$fd. each. C_1 is connected, by means of its own pigtail leads, directly between the coaxial input jack, J_1, and the stator plates of tuning condenser C_3, as may be seen in Fig. 3. The other coupling condenser is inside the probe handle (See Fig. 7) and is also rated at 4 $\mu\mu$fd.

Tuning Condenser. The tuning condenser, C_2, C_3, is a dual 365-$\mu\mu$fd. midget broadcast unit. Its two sections are connected in parallel by running a jumper between the two stator-section lugs. The trimmer condensers built on the sides of the tuning condenser sections must be removed before C_2, C_3, is mounted in the instrument.

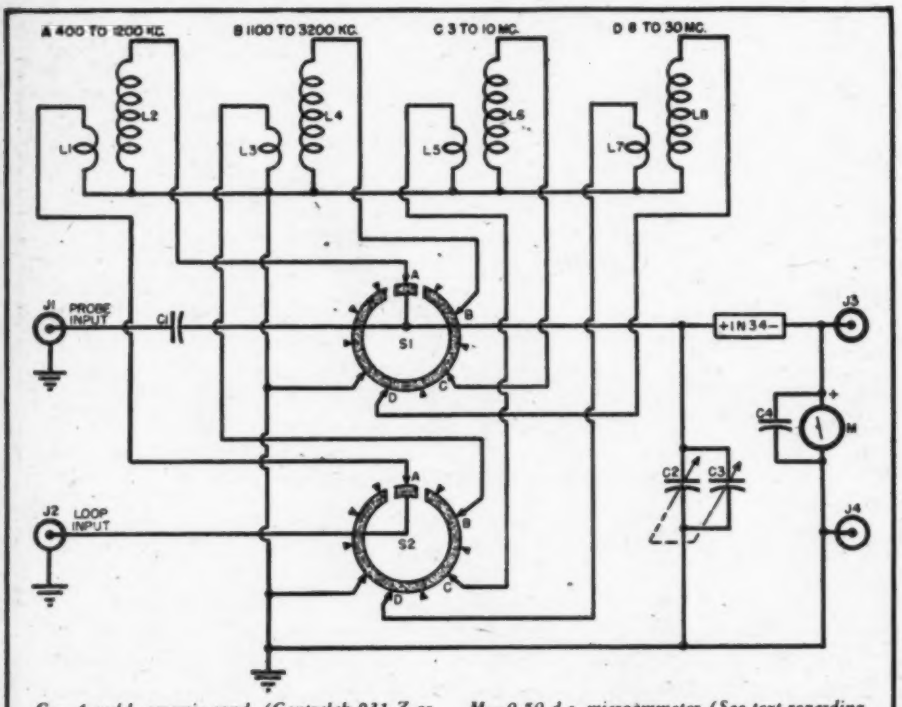
Indicating Meter. For best sensitivity, a low-range d.c. microammeter must be employed. A 0-50 d.c. microammeter is indicated in Fig. 6 and is seen on the front panel in Fig. 1. The author required a meter of this sensitivity, since the instrument was intended for use as a weak-signal tracer and field strength meter, as well as a frequency checker. Full-scale deflection of 50 microammeters is obtained with .1 volt r.m.s. input at jack J_2. However, an individual builder, if he prefers, may use a larger meter, such as a 0-500 d.c. microammeter or a 0-1 d.c. milliammeter, if he will remember that a much stronger signal will be required for a respectable deflection, and also that calibration will be somewhat more difficult with these large meters because of the correspondingly slight deflection obtained when a test oscillator is used for calibration.

Crystal Diode. The crystal diode is a 1N34 germanium unit. Silicon crystals, such as the 1N21 series, are not recommended for use in the signal checker, because of their lower voltage handling ability.

Meter and Headphone Terminals. Pin jacks J_3 and J_4 permit the microammeter to be used externally. In this way, the relatively expensive meter is not tied up completely in the frequency checker. When the meter

(*Continued on page* 164)

Fig. 6. Complete circuit diagram of signal checker. Switches S_1 and S_2 are ganged (note unused contacts). Jacks J_3 and J_4 enable use of the microammeter externally when switch S_1-S_2 is set to one of the unused contact positions. Headphones may also be connected to J_3 and J_4 for aural monitoring of modulated signals.



C_1—4 $\mu\mu$fd. ceramic cond. (Centralab 931-Z or equivalent)
C_2, C_3—Dual 365 $\mu\mu$fd. var. cond.
C_4—.001 μfd. mica cond.
J_1, J_2—Coax chassis connectors (Amphenol 80-C)
J_3, J_4—Insulated phone tip jacks
L_1 to L_8—See coil table
M—0-50 d.c. microammeter (See text regarding use of larger meters)
1N34—Crystal diode (Sylvania type 1N34. Do not use silicon crystals, such as the type 1N21, in this circuit)
S_1, S_2—2-ganged sections of a 2-pole, 2-gang, 11-pos. shorting type rotary selector sw., ceramic insulation (Centralab 1412)

Bond Geddes' report on Radio Industry*

Presenting some of the most-often requested figures concerning the radio industry, its employment and its production.

BOND GEDDES
Executive Vice-President & General Manager, Radio Manufacturers Assn.

THE Radio Manufacturers Association, of which I am the Executive Vice-President and General Manager, comprises about 325 of the principal manufacturers of all types of radio-electronic equipment, including radio and television sets, transmitters, tubes, parts, accessories, and supplies. By volume the Association's member-manufacturers represent about 90 per-cent of production, although there are probably 1000 manufacturing companies in whole or part interested or allied with the industry. Included in the industry are 193 receiving set manufacturers (as compared with 57 before the war), and of these about 157 set manufacturers are in production to more or less degree, and there are about 65 major set manufacturers with all but one of these in the RMA membership. There are also thirty manufacturers of electric phonograph equipment.

The radio industry has a factory employment estimated at 300,000 workers. In addition there are about 1500 radio distributors and wholesalers, and around 35,000 to 50,000 dealers, comprising an estimated trade employment of 125,000 employees. Also there are 40,000 to 50,000 servicemen, making a total industry employment of roughly 500,000.

Factory employees in the industry include thousands of skilled and highly paid workers, largely organized in unions. The average hourly wage of member-manufacturers for October, 1947 was $1.19 per hour, and $47.98 weekly, the highest on record in the industry. This compares with the prewar hourly rate average of $.68 in 1941. These figures released by the Labor Department include unskilled as well as skilled factory labor, janitors, laborers, plant guards, etc.

Although the aggregate industry

(*Continued on page* 168)

Table 1. Summary of industry statistics covering 1940, 1941, 1942, 1946, and 1947.

FM SET PRODUCTION (1946-1947)

Year	Units	Dollars (Retail)	Per-cent of Total Sets Units	Dollars
1946[2]	181,485	61,704,900	1.4	7.06
1947[3]	1,150,000	311,000,000	6.4	24.46
Total	1,331,485	372,704,900		

TELEVISION SET PRODUCTION (1940-1947)

Year	Units	Dollars (Retail)	Per-cent of Total Sets Units	Dollars
1940	1,342	427,600	.01	.12
1941	389	152,800	.01	.03
1942[1]	953	176,400	.02	.86
1946[2]	5,367	2,050,200	.03	.23
1947[3]	175,000	102,000,000	.97	8.00
Total	183,051	104,807,000		

RADIO SETS WITH PHONOGRAPHS (Including FM and AM)

Year	Units	Dollars (Retail)	Per-cent of Total Sets Units	Dollars
1940	1,120,674	75,000,000	9.4	21.19
1941	1,639,176	140,300,000	11.9	29.94
1942[1]	909,151	90,500,000	21.1	44.36
1946[2]	3,081,448	354,400,000	19.2	40.56
1947[3]	2,750,000	591,500,000	15.2	46.50
Total	9,500,449	1,251,700,000		

ALL SET PRODUCTION (1940-1947)

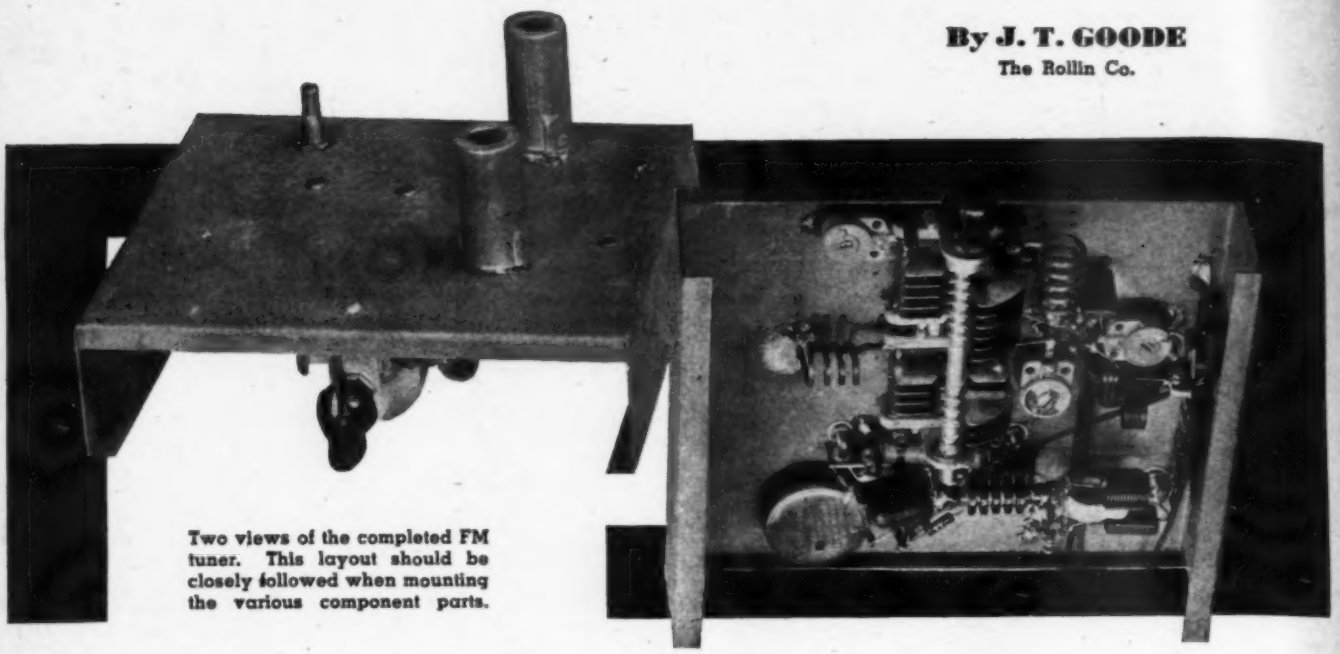
Year	Units	Dollars (Retail)
1940	11,855,039	354,000,000
1941	13,664,788	468,600,000
1942[1]	4,306,085	204,000,000
1946[2]	16,019,754	873,700,000
1947[3]	18,000,000	1,271,400,000
Total	63,845,666	3,171,700,000

NOTES: [1] Civilian radio production halted by WPB on April 22, 1942 and not resumed until late in 1945.
[2] Radio set and parts pricing under OPA control until Oct. 31, 1946.
[3] Estimated totals—final reports not yet available.
[4] No records on FM set production by years prior to 1946. FCC estimated about 400,000 prewar FM sets were manufactured.

*The figures given in this article were excerpted from Mr. Geddes' testimony before the U. S. House of Representatives' Committee on Education and Labor investigating the AFM ban on recordings.

A LOW COST FM TUNER

By J. T. GOODE
The Rollin Co.



Two views of the completed FM tuner. This layout should be closely followed when mounting the various component parts.

Operating as a sideband detector, this superregenerative FM tuner provides relatively good reception at extremely low cost.

NEW FM transmitters are now broadcasting regular programs in many localities that heretofore were not served by FM.

While radio manufacturers are already well in production on FM receivers, the FM is usually incorporated in an FM-AM combination deluxe unit which is rather expensive.

Several companies are manufacturing FM tuners which can be connected to the audio amplifiers of any receiver. This reduces the expense of FM reception as these units usually consist of a complete receiver minus audio amplifier and speaker.

FM receivers and tuners are also available in kit form. To the experimenter or amateur, the kits are proving rather attractive from the economic standpoint.

All of the above-mentioned equipment is expensive when compared to the FM tuner described in this article.

A superregenerative receiver can be used to receive FM transmissions. By adding a few refinements to a superregenerative receiver, a very economical unit may be constructed from "junk box" parts. Even if all of the parts have to be purchased, the total expense would be under $15.00. It will only take about three hours to construct this tuner.

While such a receiver does not have all the features of a true FM receiver, namely "noise elimination," on the other hand, the sensitivity of a superregenerative receiver continually decreases as the signal strength increases, which provides a certain amount of noise reduction.

Since most FM transmitters are operating with fairly high power, such a condition insures satisfactory signal strength for most localities which are covered by FM transmission.

A straight superregenerative receiver should not be used for FM reception since such a receiver actually transmits interference on the same frequency to which it is tuned. This would cause interference to receivers operating in the same locality.

By using a superregenerative receiver as the i.f. channel of a superheterodyne, the interference possibility is eliminated. The converter of the superheterodyne provides a stage of isolation, divorcing the superregenerative stage from the antenna. The superregenerative stage is tuned to a lower frequency (approximately 31 mc.) which, in turn, gives added assurance of no interference on the receiver frequency.

Anyone who has constructed a superregenerative receiver is well aware of the difficulties encountered in maintaining good sensitivity over a wide range of frequencies. In the construction of this tuner that particular difficulty is eliminated since the superregenerative channel can be adjusted for optimum sensitivity at one frequency.

The FM tuner consists of a 6BE6 mixer and high frequency oscillator and a 6J6 superregenerative detector. One half of the 6J6 is not used. If additional audio gain is desirable, the other half of the 6J6 can be used as an audio amplifier. A 6J5 can be used instead of the 6J6 if desired. The operation of the tuner is as follows.

The grid circuit of the 6BE6 is designed to cover the tunable range of 88 to 110 mc. The oscillator circuit of the 6BE6 is designed to tune from 57 to 79 mc. These two tuned circuits are tracked to produce a beat frequency of 31 mc. over the tunable range.

The plate circuit of the 6BE6 is tuned to 31 mc. This circuit is coupled to the tuned circuit of the 6J6 superregenerative detector which is likewise tuned to 31 mc.

Assume that a FM signal is being transmitted on 100 mc. The grid circuit of the 6BE6 is tuned to 100 mc. and the oscillator circuit is tuned to 69 mc. The received frequency will beat with the high frequency oscillator, producing an i.f. frequency of 31 mc. This signal is, in turn, detected by the 6J6 circuit producing an audio voltage. This voltage may be fed into any convenient audio amplifier. The audio amplifier in the average receiver will be adequate.

Since only one tuned circuit is involved, selectivity is extremely broad. For FM reception, the circuit is tuned so as to utilize the slope of the curve.

The circuit is tuned so the center frequency is approximately 100 kc.

down the slope of the curve. As the frequency is altered by modulation (FM), the sensitivity is increased and decreased due to the slope of the curve of the tuned circuit. This action causes an a.c. voltage to be generated by the detector and the frequency of this voltage will be that of the modulation.

Distortion will be extremely low when the straight portion of the curve is used.

This point of operation is not difficult to obtain. Simply tune the receiver for clear reception. There will be two such points, one on either side of the selectivity curve.

Construction Notes

Considerable care should be exercised in making the chassis layout. Parts should be located in such a way that lead lengths are held to a minimum.

The variable condenser is a dual standard, 11-plate, double-spaced unit, Four plates are removed from the rear section which tunes the grid circuit of the 6BE6. Removal of these plates results in satisfactory tracking over the entire FM band.

Although the plate circuit of the 6BE6 and the grid circuit of the 6J6 are tuned to the same frequency, the coils are wound with a different number of turns. This procedure results in optimum operating conditions.

Ceramic trimmers are used throughout and are recommended. Compression type trimmers are subject to slight changes in capacity which, if encountered, will cause serious frequency drift.

It is not unusual to "hand-pick" the tubes for a superregenerative detector stage. Some tubes that operate satisfactorily in an amplifier circuit will not give the same service in a superregenerative circuit. If the FM tuner does not operate when first turned on, try changing tubes before changing component parts.

Chassis Layout

The variable condenser is located in the center of the chassis. The 6BE6 tube socket is mounted so that lead length is divided equally between the two sections of the variable condenser. The 6J6 tube socket is mounted approximately three inches from the 6BE6 tube socket. This allows sufficient space to mount the 6BE6 plate coil and the superregenerative tank coil.

The 6BE6 oscillator coil is soldered to the front section of the variable condenser and ground, making it self supporting. The oscillator trimmer is soldered to the other side of the variable condenser and ground.

The 6BE6 grid trimmer condenser is soldered directly to the grid prong of the 6BE6 tube socket and ground. The grid coil is soldered to the other side of the back section of the variable condenser, and ground. The antenna coil consists of one turn of wire soldered to the chassis and located near the ground end of the grid coil.

The 6BE6 plate trimmer is soldered directly to the tube socket terminal, and ground. The plate coil is supported by the plate prong and a terminal strip. The terminal strip is bypassed by a .002 μfd. condenser at this point.

The 6J6 coil and trimmer condenser are soldered directly to the plate prong of the 6J6 tube socket and the other end of the coil and trimmer connect to a terminal strip. The 6J6 grid condenser connects from the terminal strip to the grid prong of the tube socket. The r.f. choke and filter resistors are supported by another terminal strip.

Although the variable resistor in the plate circuit of the 6J6 is not absolutely necessary, it does make possible a more precise adjustment of this stage.

The connecting cable consists of two filament leads, a ground, and a "B plus" lead. Shielded wire is required to feed the audio output of the FM tuner to an audio amplifier.

Power consumption is 6.3 volts at .75 amps. and the plate drain is less than 10 ma. The plate voltage is not critical, approximately 90 volts. Filament and plate voltage for the tuner may be obtained from the audio amplifier or radio used in conjunction with this equipment. The power consumption of the tuner is sufficiently low to allow tapping into the power supply of the average 5 tube a.c. receiver without causing serious overload. At the same time the audio section of the receiver is connected to the tuner and the FM receiver is complete.

If the plate voltage of the receiver is excessive, insert a resistor in the "B plus" lead of the tuner and adjust the value so that approximately 90 volts is available for the operation of the tuner.

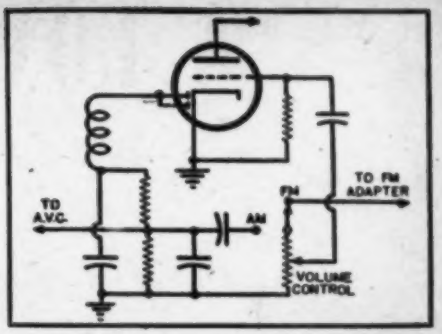


Fig. 1. Diagram shows method of connecting FM tuner to any conventional AM receiver. Receivers equipped with a phono input can be connected directly to the tuner without any circuit alterations whatsoever.

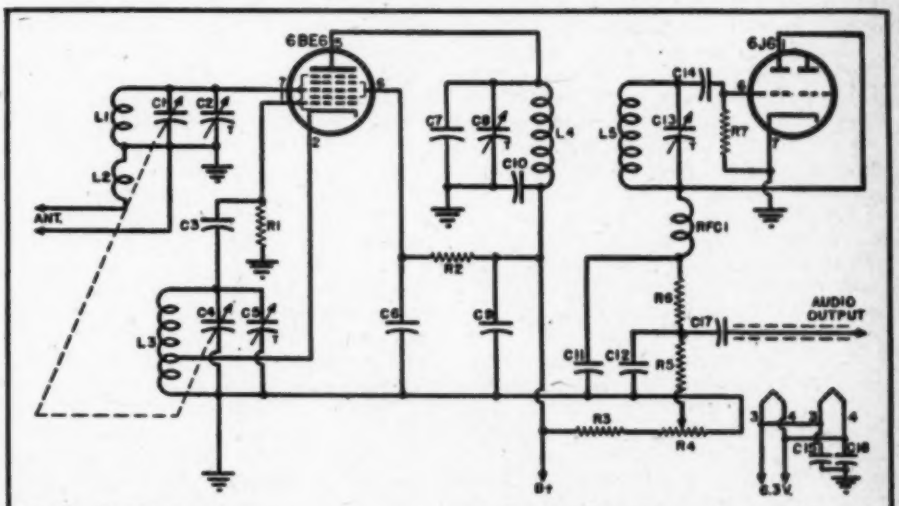
Some receivers have a terminal available for a phonograph connection. In this case the audio connection from the tuner may be attached directly to this terminal. Receivers without this terminal will require the addition of a switch and terminal or jack.

The switch employed is of the single-pole, double-throw type. It is wired in such a manner that it is possible to transfer the audio amplifier of the receiver to either the radio or the tuner. Connections are made at the volume control of the receiver and the same control is used for AM and FM reception. See Fig. 1.

Assuming that an appropriate audio amplifier and power supply are connected to the tuner, the testing procedure is as follows. Turn on the equipment and allow a warm up period of a few minutes. If the 6J6 stage

(*Continued on page* 171)

Fig. 2. Complete schematic diagram of tuner. An external power source is required.



R_1, R_6—20,000 ohm, ½ w. res.
R_2—250,000 ohm, ½ w. res.
R_3—10,000 ohm, 1 w. res.
R_4—10,000 ohm wirewound pot.
R_5—30,000 ohm, ½ w. res.
R_7—1 megohm, ½ w. res.
C_1, C_4—35 μμfd. gang cond.(Bud MC 1885A)
C_3, C_5, C_9, C_{12}—30 μμfd. ceramic trimmer cond.
C_2, C_7, C_{14}—50 μμfd. mica cond.
C_6, C_{10}, C_{13}, C_{16}—.002 μfd. mica cond.
C_8, C_{17}—.01 μfd., 400 v. cond.
C_{11}, C_{15}—.0002 μfd. mica cond.
L_1—3 t. #16 en., ⅜" i.d., ⅛" spacing
L_2—1 t. #16 en., ⅜" i.d., ⅛" spacing
L_3—5 t., tap 1½ t., #16 en., ⅜" i.d., ⅛" spacing
L_4—6 t., #18 en., ⅜" i.d., closewound
L_5—13 t., #18 en., ⅜" i.d., closewound
RFC_1—2.5 mh. r.f. choke
1—6BE6 tube
1—6J6 tube

Television—EXCLUSIVELY!

... paid real dividends to this ... in the New York City area.

By
MAX ALTH

JOHN R. PORTERFIELD, in conjunction with *UVX Industries, Inc.,* has just entered the retail television field in a big way. He has opened a salon in Yonkers, New York dedicated solely to selling and servicing television receivers.

The opening of this salon is not an off-the-cuff proposition, but the result of nine months of patient study. Here is the story behind the opening, and the picture to date.

UVX Industries, Inc. is a corporation with many years as national, factory representatives for various electrical specialities manufacturers behind them. They had a certain amount of surplus capital on hand, and were looking for the best way in which to invest this money. They decided upon retail television sales for several reasons.

Since television is a growing field, they would be working into an expanding market rather than a static, or a diminishing market. They already had retail electrical appliance merchandising know-how, and they had experienced retail merchandising sales and management personnel.

Having the general knowledge, they looked about and teamed up with John R. Porterfield, who had the specific knowledge. John Porterfield has been associated with television in one capacity or another for more than ten years.

Together they decided that the New York area was the logical place for a television sales outlet because of its high population concentration, and the number of television broadcasting stations in operation.

However, New York City was not selected for their pilot retail outlet for the following reasons. The unreasonably high rent being asked for the available locations practically foredoomed any business that might open there. New York City is not a typical American community, and sales experienced in New York City might not be applicable to other localities, and lastly, sales while being more or less unlimited in potential numbers, are definitely limited as far as the percentage of homes is concerned.

Apartment house owners in New York City will not permit their tenants to erect individual antennas. Each tenant must hook his receiver to a common antenna, or do without.

While satisfactory multiple outlet antenna systems have been devised, and are appearing on the market, few apartment houses have them as yet, and until that occurs the number of possible television set sales in New York City will remain limited.

However, a sales office was organized, and set up at 50 Church Street, and a large crew of part, and full-time salesmen cover the city from there.

With New York relegated to a secondary position, the company looked toward the suburbs.

Long Island was considered and rejected because of its low concentration of population. It was a good locafor a retail television outlet, but not the best. New Jersey was considered next, and also rejected because of the large number of television retailers already established. Westchester County, which lies directly north of New York was considered, and chosen when *DuMont* proffered an exclusive franchise in Yonkers, which is in Westchester County.

The present site of the salon at 63 South Broadway in Yonkers was not selected. It merely happened to be the only store in the center of town that was available. Yonkers has a population of 140,000, and is within easy commuting distance of New York.

The organization rented the first floor, and basement. The entire front of the small building was painted white, and the name, "Porterfield Television" was lettered in red across the face of the building. The single color, and the lettering gives the passerby the impression that the entire three floors are used by the company.

The store proper was broken up into three rooms. One, the main showroom, opens onto the street through two show windows and a door, and has a frontage of about thirty feet. In this room the television sets are displayed. Chairs are provided, and individual sets demonstrated. The second room is connected to the first by means of an archway. This is the "teletheater" which seats thirty-five people comfortably for a television show. The third room is used as an office. The basement is used for storage while servicing is done at another location.

So much for the physical layout of the salon.

The opening gun of the sales attack was fired at the Westchester Home Show in the exhibition hall where many other county merchandisers displayed their wares.

Next came a series of spot advertisements, ten in all, over WFAS, a local broadcasting station. These were followed by a quarter page display ad in the *Herald-Statesman,* a leading Yonkers paper, and from then on, a continuous series of sales promotions.

Two television sets were installed in the lobby of a local movie theater. Not merely placed there, but connected to power and an antenna, and turned on every evening.

Free tickets, entitling the signer to a chance in the drawing, were placed with the box office attendant, and given to anyone requesting one. The detachable stubs of these tickets were placed in a large box in the lobby of the theater, and a drawing held at the end of one month.

Meanwhile, a two minute advertising trailer was shown at every performance during the month the television set was being offered.

An ad was also run in the theater program leaflet which the theater distributes to its patrons.

Mention of the free prize was made in the newspaper ads of both *Porterfield Television* and the theater.

A large sign in the window of the store invites the general public to come in and see a television show. In the other window the company has posted a weekly list of programs. Sometimes the windows themselves are chalked up with signs advertising the evening's program. For example, the royal wedding pictures were advertised, and drew a large crowd.

Television program schedules for the coming week are mailed to all those who show an interest, and to those who have purchased television receivers. Those people who have indicated an interest in a particular type of program, on the cards that are circulated, are invited by mail to attend whenever their particular interest is being telecast.

The public is advised that no sales pressure will be exerted, and none is—directly. At the end of each teleshow, or before, as the case may be, one of the salesmen will give a short talk on television with a view to stimulating the listeners' enthusiasm for television. No direct sales appeal is ever made. Sales leads are, of course, picked up through these public demonstrations.

The greater portion of the teletheater audience is there by invitation, the rest walk in from the street. Of the latter group a percentage is dead wood—youngsters, and the casually curious. However, there is no doubt that the teletheater more than pays its cost of operation.

The leads secured through the salon, newspaper ads, etc., are followed up by the sales force. The salesmen are in the unique position of being able to advise on television without having to push any particular brand. The company has franchises from the four major television manufacturers whose sales comprise ninety per-cent of all the television sets sold in the country, *RCA, Philco, DuMont,* and *U.S. Television.* All national advertising is to their benefit. A boost for any television set by any manufacturer is a boost for *Porterfield* salesmen. They can sell the customer any set he wants.

Because of this favorable franchise position they organize their sales line in an advisory fashion, going to the customer's home, helping the customer select the room best suited for the set, the best location in that room, and the set best suited to the customer's needs. Thus the salesmen have an honest impartiality that gives the customer confidence in them, and all they need do is to sell television, and not any particular brand of home receiver.

Everything about this pleasant exterior invites customers to come in and "see television."

Business at the end of the first month has been so good that a large crew of salesmen have been attracted. Some work part-time, others work full-time. All draw against commission.

The service department consists of a six-man crew set up on a twenty-four hour basis. They install and service the four major sets with the exception of *RCA,* which does its own servicing and repairs.

The prompt, efficient, twenty-four hour service of this group has already brought more than one customer, dissatisfied with other repairmen, into the *Porterfield* fold. The customers like the thought of twenty-four hour service, although very few persons will actually call for service at two or three in the morning.

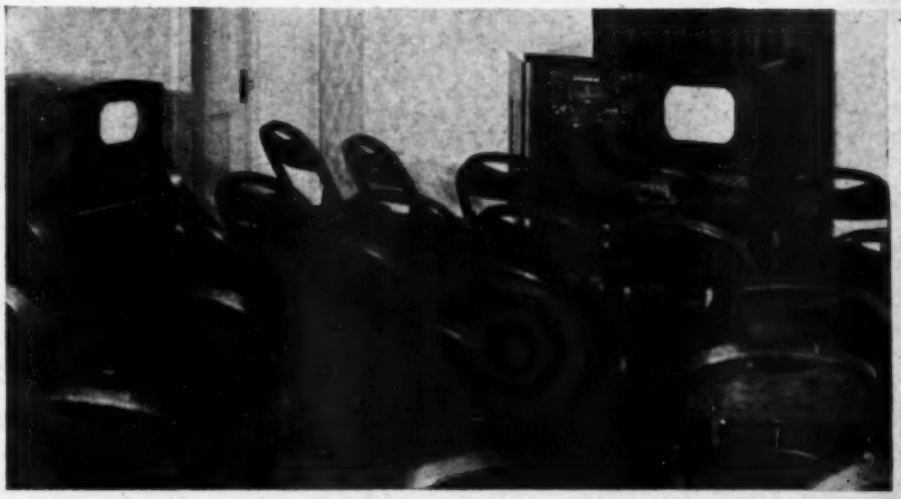
There have been, however, a percentage of nuisance calls. There always will be. Customers who have invited guests for dinner, for example, have wanted to make certain their new toy would perform satisfactorily—so they call the service department despite the fact that the set was working perfectly at the time of the call.

The men usually work in two-man teams, rarely going out individually unless it is a known problem which they are tackling. The charge for a two-man team, on a non-contract basis is $7.50 per hour, plus material. The charge for one man is $4.00. This figure is low in view of the pay a good television repairman receives. Installation charges, and the accompanying service periods are those set by the manufacturers.

Every effort is made to repair the set in the customer's home. The chassis is pulled only when it seems likely that a repair will take an inordinate

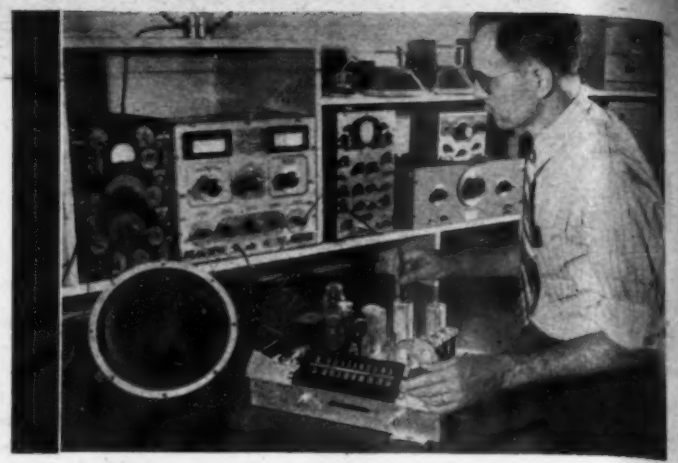
(*Continued on page* 124)

The "teletheater" has more than paid the cost of its operation by increased sales of sets.



BIRTH OF A SERVICE NOTE

Those data sheets which accompany each new receiver are the result of engineering skill plus practical servicing "know-how."



Equipment engineer checking preliminary alignment of radio. Several methods are tried, but the simplest and most foolproof technique is adopted for inclusion in the service note. Voltage data on the set is also taken at this time.

By HARRY D. HOOTON

Technical Supervisor, Service Dept.
Westinghouse Electric Corporation

THE service notes and instruction bulletin sent out by every radio manufacturer with each new set are certainly not conceived overnight. As a matter of fact, service notes in their present form might not exist at all, were it not for the close cooperation of all contributing to their development.

When the engineering department designs a new model, a technician in the service laboratory receives all preliminary information regarding the circuit and any special features or innovations in the design. Receiving this material in advance, he can be fairly certain by the time the engineers have a laboratory model available what service information and alignment techniques will be required.

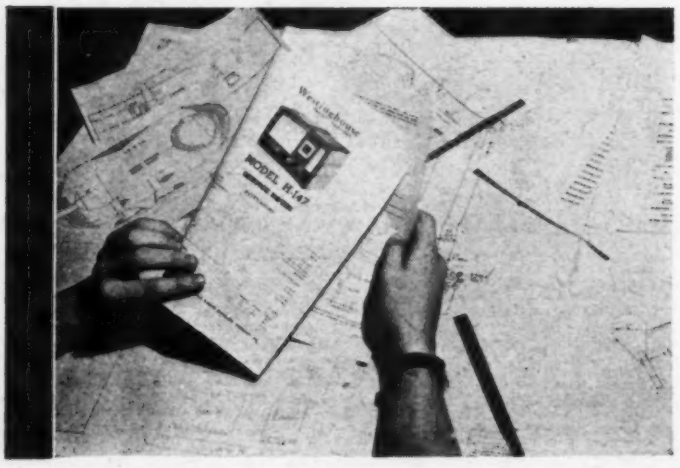
When the engineers complete the model, the draftsman and technician in the service department analyze it and determine what drawings will be required for the instruction booklet to be shipped with the radio. Usually, a projection drawing showing tube locations and a view with the tuning controls and dial are required; also, any special connections to accommodate a record player or an FM antenna must be shown. While they have the model, the draftsman makes measurements and rough sketches; the technician sees that all his original alignment technique and service information notes are complete and correct.

After a close analysis of the construction, the time study department breaks up the set into a number of simple operations. They make a trial run of 25 sets and then return them to the engineering department for careful checking of inherent char-

(*Continued on page* 169)

→ Equipment engineer conferring with draftsman after preliminary voltage and alignment data are established to be certain all essential data is included on schematic and other servicing drawings.

← Engineer and technical writer checking over alignment details and voltage charts. Together they determine best service note layout to emphasize service parts in a particular receiver. Others handle work involved in the preparation of the parts lists, etc.



→ Proof copy from printer being checked against original dummy layout in the final step before printing of notes.

Compact Power Supply is Transformerless and Tubeless

By GUY DEXTER

Fig. 1. Two views of complete power supply. All parts are mounted underneath the metal chassis.

This power supply, using selenium rectifiers, will deliver up to 600 volts depending on load current.

IN VOLTAGE multiplier circuits, such as doublers, triplers, and quadruplers, the new selenium dry-disc rectifiers offer the advantages of small size, economy, low heat dissipation, and extreme simplicity. In addition to those desirable features, a selenium voltage multiplier also has better voltage regulation than an equivalent vacuum tube outfit; is able to withstand a surprising amount of careless handling; eliminates all hum fields; and, having no filaments or heaters, can be placed into operation instantly.

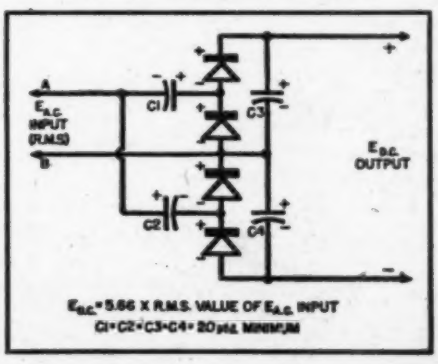
Voltage multiplier circuits long have interested radio constructors and experimenters, since these circuits deliver high voltages without benefit of transformers of any kind. Composed only of diode rectifiers and condensers, a voltage multiplier circuit reduces the weight and dimensions of a power supply unit materially. The best-known voltage multiplier undoubtedly is the doubler, since that unit formerly has been employed widely in midget radio receivers and in some test instruments and electronic devices. The tripler and quadrupler, and higher-order multipliers, are not as well known except to power supply students and to high-voltage engineers.

The small-sized power supply described in this article employs a voltage quadrupler circuit. The basic portion of this unit is four selenium rectifiers and four electrolytic condensers. In addition to the basic circuit, an output filter section has been included.

The basic quadrupler circuit is shown in Fig. 2. This arrangement will be recognizd as two half-wave voltage doublers connected so as to have their a.c. inputs in parallel and d.c. outputs in series. Polarities of both rectifiers and condensers are very important in this circuit. If the polarities shown in Fig. 2 are not followed exactly, the components will be damaged or the circuit will not deliver full output voltage.

Simplified operation of the quadrupler circuit corresponds to that of two doublers in combination: On alternate half-cycles of a.c. input voltage, first C_1 and then C_2 is charged, each to a potential equal to the peak value of the a.c. input voltage minus the small drop in the rectifier (rectifier 2 charges condenser C_1 when input terminal B is positive, and rectifier 3 charges condenser C_2 when input terminal A is positive). Also, when input terminal A is positive; rectifier 1 conducts, charging condenser C_3 to a potential equal to the peak value of the a.c. input voltage plus the charged voltage of C_1 (also equal to the input peak) minus the small drop in rectifier 1. This results in a voltage across condenser C_3 almost equal to twice the peak value of the a.c. input voltage (2.82 x $E_{a.c.}$).

Fig. 2. Basic quadrupler circuit.



Likewise, when terminal B is positive; rectifier 4 conducts, charging condenser C_4 to a potential equal to the peak value of the a.c. input voltage plus the charged voltage of C_2 (also equal to the input peak) minus the small drop in rectifier 4. This results in a voltage across C_4 nearly equal to twice the peak value of the a.c. input voltage (2.82 x $E_{a.c.}$). The final result of this action is that a d.c. voltage appears across the output terminals equal to the sum of the voltages across C_3 and C_4. This sum is four times the peak value of the a.c. input voltage (5.66 x $E_{a.c.}$).

This means that a d.c. output voltage of 650 may be obtained with an r.m.s. input voltage of 115, when low direct currents are drawn. As the output current drain is increased, the output voltage drops somewhat. Voltage regulation is improved considerably by employing large capacitances for C_1, C_2, C_3, and C_4. Each of these four capacitances must be equal and, for best operation, never should be lower than 20 μfd.

From the preceding explanation of the circuit operation, it is evident that condensers C_1 and C_2 must have a minimum d.c. working voltage rating equal to the *peak* value of the

(*Continued on page* 184)

By
CARL V. HAYS, W6RTP

By popular request — a conventional, easy-to-build table model home receiver.

A SIMPLE B. C. SUPER

Two views of the home-built, broadcast-band radio receiver.

ORIGINALLY built as "something to get by on" until commercial manufacturers could again get in production, this little 5-tube, a.c. broadcast job has performed without a single component failure since 1944; has elicited favorable comment about its tonal qualities and appearance from all who have heard it; has consistently brought in Midwest stations in the late winter evenings with only its built-in loop antenna, and represents so much for so little that the author felt others might be glad to have the opportunity of duplicating this smooth performing little job.

The design is perfectly simple and orthodox—is in fact a circuit used by one of the major manufacturers for years, and consequently is completely free of bugs. Built as shown in the photographs and according to the schematic, anyone can be sure of good performance.

The only change in the model shown from the original is in the substitution of a choke in place of R_1, but this was done only because a choke was handy—it is recommended that the circuit be copied exactly as shown in the diagram.

The 6SA7 used as the mixer-oscillator gives more than enough gain to drive the single 6SK7 455 kc. i.f. stage, using inexpensive but efficient i.f. transformers of a standard type. A single diode-connected 6SQ7 gives adequate second detection and very nice a.v.c. action on strong signals, which are the rule on this band. The triode audio section of this same tube serves as a compact driver for the output stage which requires a low current drain 6K6GT to drive the five-inch PM speaker.

Careful duplication of parts in the bias section of the power supply will give the right grid voltage on the output stage thus insuring a minimum distortion content, even at full volume. The gain of the receiver is, incidentally, more than enough for house volume on all stations within a fifty mile radius.

The power requirements are quite modest, a small 50 mil. power transformer of the half-shell variety with a 6X5GT rectifier working into an efficient but simple filtering system will do.

Before laying out the chassis it might be wise to study the photographs in order that the layout can be followed exactly. This is recommended, since the receiver will be just that much easier to build and get going. In the top chassis photo, with the dial towards the viewer, the metal tube at the right rear of the tuning condenser is the mixer-oscillator, 6SA7; directly behind it is the first i.f. transformer, T_1. To the left of this is the i.f. tube, 6SK7; followed by the second i.f. transformer, T_2, directly to the left. Next, in a straight line along the rear chassis edge, are the 6SQ7 detector-audio tube, the 6K6GT (or 6F6) audio output tube, and the 6X5GT rectifier. Directly in front of the rectifier tube is the five-inch PM speaker with the output transformer mounted on top of it. The speaker frame is bolted to the chassis by means of long 6-32 screws and spacers so that the speaker fits snugly against the cutout speaker grille on the left end of the cabinet, when the chassis is bolted in place. Directly to the right of the speaker is the power transformer, T_3. The underchassis photographs may be followed easily by referring to the parts topside, then spotting them in their reversed position from below. Wiring is extremely simple and easy, since the chassis pan is exceptionally roomy, thus eliminating the bothersome crowding of parts. The loop, affixed to the rear of the chassis by means of spacers, is a commercial unit and is color-coded so that no trouble should be experienced in connecting it.

The dial assembly, used in this particular model, is one of the slide-rule types, but was used simply because it was available. Any type preferred by the builder will work just as well, as

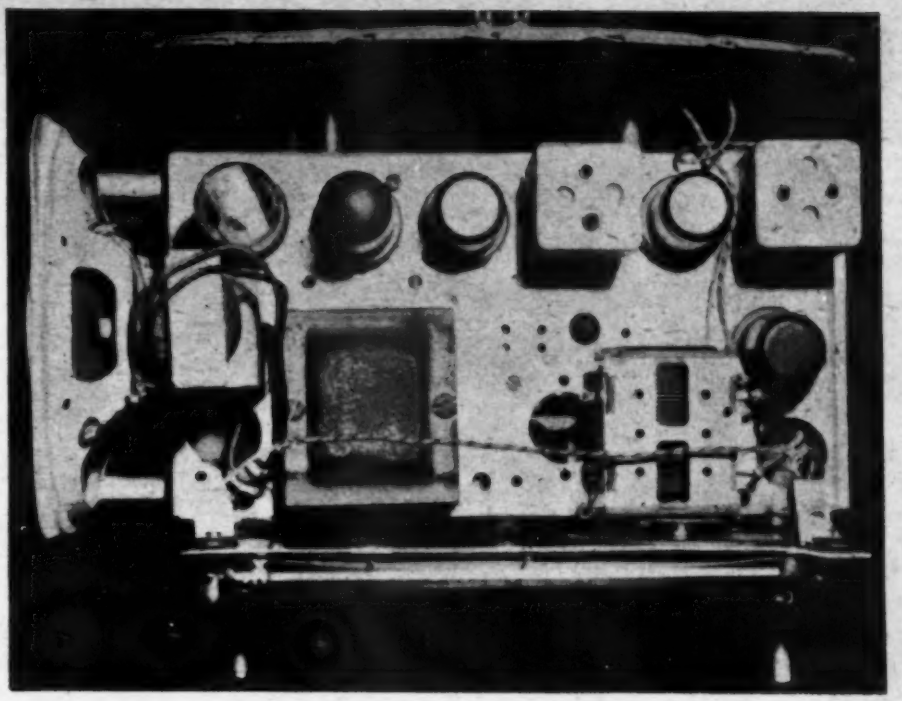
long as its calibration is standard, and matches the tuning condenser used. Cabinets are now generally available, some even come complete with the dial as an integral part, so no trouble should be experienced from this angle. A home-made unit was used to house this receiver as the dial escutcheon which was originally for FM calls could be replaced by a heavy white cardboard with the typed call letters of the major local stations, thus making station selection a very simple matter.

Although the loop, as it comes from the manufacturer, is provided with a connection to permit the use of an external antenna, it has never been necessary to attach one as stations in Texas, Louisiana, Illinois, Oregon, Washington, and many other states have been received regularly in the late winter evenings with adequate volume and clarity.

The controls need no explanation. The control on the left in the front view is the a.c. switch and volume control, and that on the right is the station selector. A pulley and conventional dial-cord drive are used with this dial assembly. Operation is smooth and it has given no trouble of any kind so far.

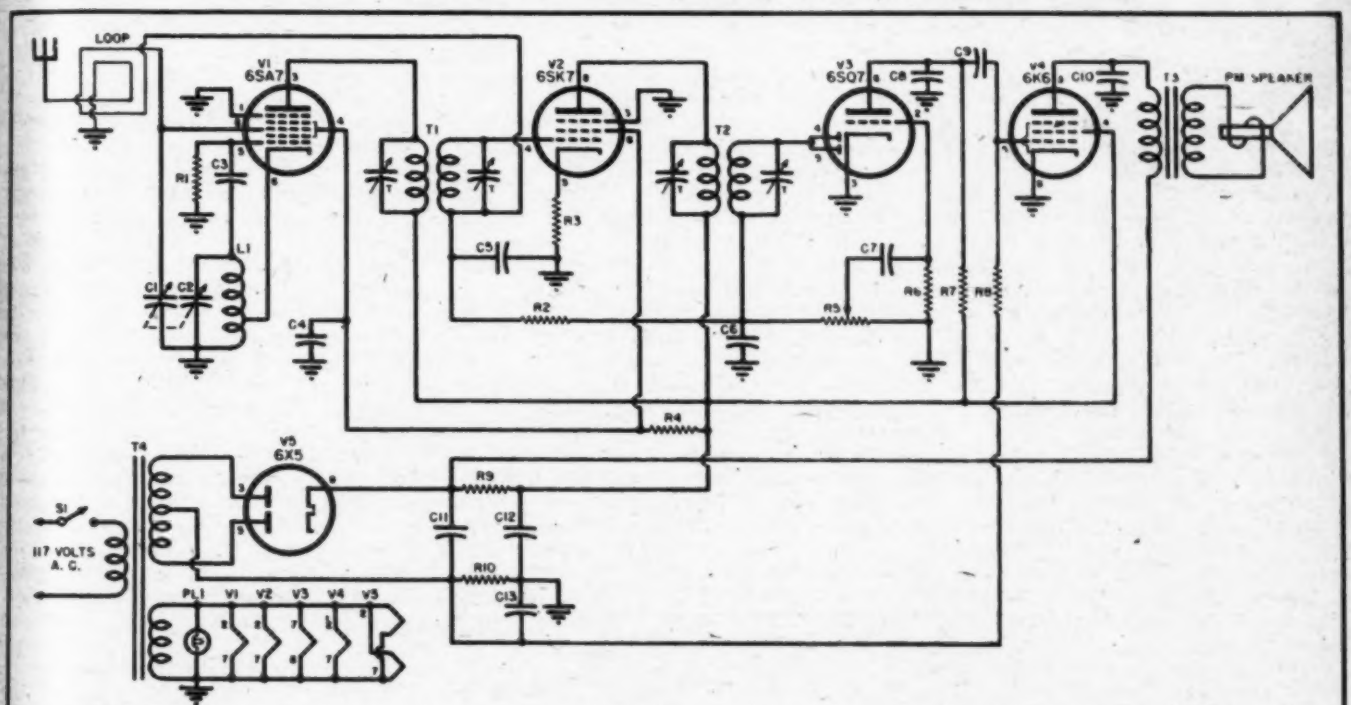
As a matter of convenience, it is perhaps best to wire the power supply first, testing it before proceeding with the construction. Voltages are not critical, as approximately 250 volts (under load) will suffice. After the power supply is completed, wire all filaments in parallel, grounding one filament pin of each tube directly at the sockets. The use of the cathode-type 6X5GT eliminates the need for a 5-volt winding for the rectifier, but if a dual filament transformer of the right size is available by all means use it—then substitute an 80 or similar tube for the 6X5GT. In this case

(*Continued on page* 170)

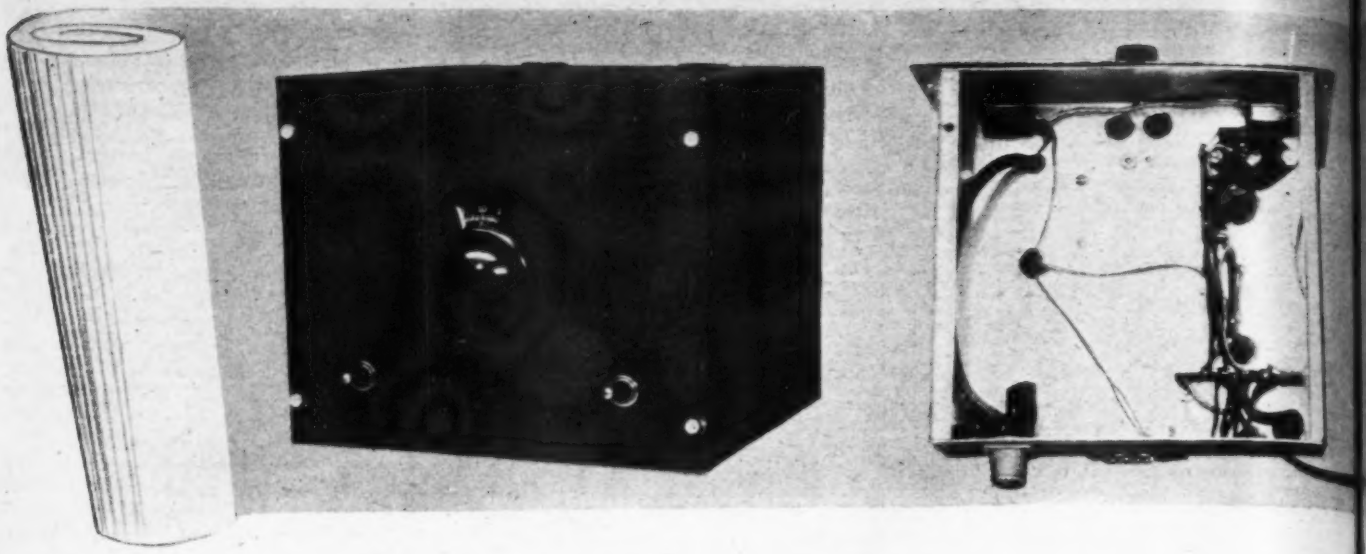


Top view of receiver shows placement of component parts.

Circuit diagram is typical of many commercially built, a.c. operated, five-tube home receivers.



R_1—25,000 ohm, ½ w. res.
R_2—2.2 megohm, ½ w. res.
R_3—50 ohm, ½ w. res.
R_4—5000 ohm, 1 w. res.
R_5—500,000 ohm vol. control & sw. (S_1)
R_6—3 megohm, ½ w. res.
R_7—100,000 ohm, 1 w. res.
R_8—1 megohm, ½ w. res.
R_9—1000 ohm, 2 w. res.
R_{10}—180 ohm, 2 w. res.
C_1, C_2—Standard midget two-gang cond. with cut-plate section*
C_3—50 μμfd. mica cond.
C_4, C_5—.05 μfd., 400 v. cond.
C_6, C_8—250 μμfd. mica cond.
C_7, C_{13}—.005 μfd., 400 v. cond.
C_9—.02 μfd., 400 v. cond.
C_{11}—40 μfd., 350 v. elec. cond.
C_{12}—20 μfd., 350 v. elec. cond.
C_{13}—10 μfd., 50 v. elec. cond.
Loop—See text*
L_1—Osc. coil (tapped). Standard b.c. type for use with 455 kc. i.f.*
T_1, T_2—455 kc. i.f. trans.*
T_3—Output trans. 7000 ohm to v.c.
T_4—Power trans. 250 v. d.c. @ 50 ma.; 6.3 v. @ 3 amps.
PL_1—6.3 v. pilot light
S_1—S.p.s.t. toggle sw. (on R_5)
Speaker—5" PM type
** All coils and condensers that make up tuned circuits should be properly matched. Receiver should cover the broadcast band.*



Simplicity in a Converter

By C. W. ROESCHKE, W5MLX

This converter makes possible complete coverage of the 6, 10, and 11 meter ham bands. It will extend the range of many surplus receivers.

THE large number of surplus receivers available to the ham offer excellent performance at low cost, but have the disadvantage of not covering all the commonly used ham frequencies. It is particularly desirable to include the ten meter band in the receiver if at all possible, and if the six meter band can be included as well, the utility of the receiver is greatly increased.

In the desire to increase the frequency coverage of the surplus receiver in use here, many articles on converter design were examined to find one that fitted the needs. The majority of these designs used an r.f. stage, mixer, and oscillator. This required a minimum of three coils for each band to be covered, and seemed unnecessarily complicated. Spare coils have a bad habit of becoming misplaced or damaged, and the fewer needed the better.

It would be desirable to include bandswitching in a converter to eliminate the need for plug-in coils, but this introduces complications as well as losses at high frequencies.

In the examination of various literature on the subject of converters, an article was located in the *Proceedings of the IRE*[1] that appeared to offer promise. While this article gave no construction details, it was felt that with the information furnished, a satisfactory converter could be constructed.

To reduce the number of coils required, it was decided that the converter would use a grounded grid r.f. amplifier, followed by a mixer and oscillator. The use of a grounded grid amplifier gives a voltage gain in this application, of approximately four times, or 12 db. This type of amplifier also has the advantage of being broad-band, and is extensively used in television receivers.

The input circuit is very tolerant of various antenna impedances, with stability of the amplifier at any frequency, due to the screening action of the grid. This serves to reduce oscillator radiation to a negligible value.

As finally constructed, the converter uses a 6J6 grounded grid amplifier with the elements connected in parallel to double the transconductance. This is followed by another 6J6 as a combined mixer and oscillator. These tubes were selected as they are available at low cost in the surplus market, and give excellent performance at the high frequencies.

As only two coils are needed, one for the mixer grid, and one for the oscillator, these two coils are combined on one base. The base used is a type supplied by *National* for use with small transmitting coils. Similar types are also made by *Millen* and can be used. A piece of lightweight copper sheet measuring 1¼ inches square is used as a shield between the two coils, and grounded.

By the use of this expedient, only one coil need be changed, and the possibility of coil misplacement is reduced. Details of the coil construction are shown in Fig. 1.

The output of the converter is tuned in the vicinity of 10 mc. and fed into the antenna and ground terminals of the receiver. The choice of a high i.f. frequency insures adequate image rejection.

It is quite common in converters to take the necessary power from the receiver. If the receiver is capable of handling the additional load this is a satisfactory method, but digging into the receiver to make the necessary connections is always inconvenient. Accordingly it was decided to make the converter self-powered.

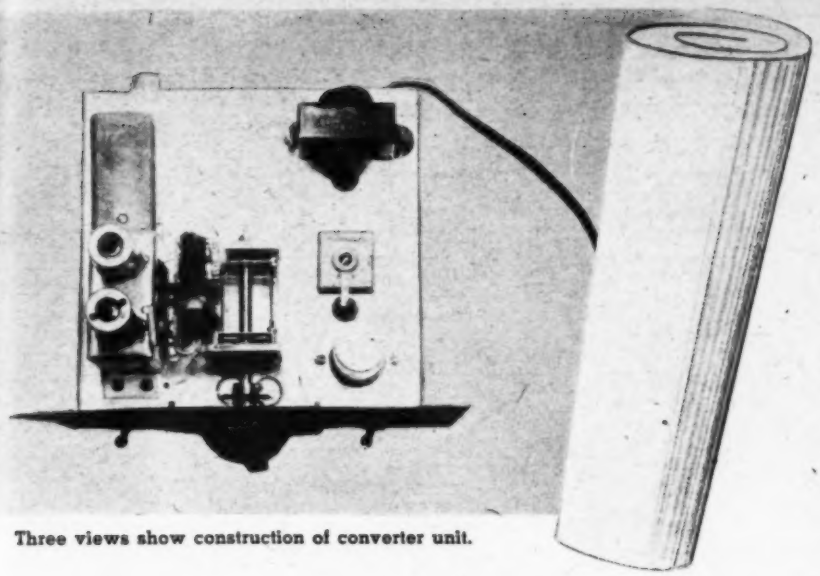
The built-in power supply consists of a 6.3 volt transformer to supply the heaters of the 6J6's, combined with a selenium rectifier to supply the necessary high voltage. The total "B" drain of the unit is in the vicinity of 25 ma. at 100 volts for the plate, and 6.3 volts at .9 amp. for the heaters. In the event the built-in power supply is not desired,

Coil specifications.

L_1	27-30 mc. 14 t. No. 14 en. closewound (Trimmer C_2 not used)
L_2	27-30 mc. 8 t. No. 14 en., ⅜" long, tap at 3 t. (Trimmers C_8, C_{10} used)
L_3	50-54 mc. 7 t. No. 14 en. closewound (Trimmer C_2 used)
L_4	50-54 mc. 10 t. No. 14 en., 1" long, tap at 3 t. (Trimmer C_{10} used, C_8 is not used)
L_5	20 t. No. 20 en., ⅜" form, space to ⅞" length
L_6	5 t. No. 20 en. closewound at cold end of L_5

Note: Coils L_1 and L_3 are wound ½" diameter and mounted on plug-in type assembly. (See Fig. 1.)

[1] Sziklai, G. C. and Schroeder, A. C.: "Cathode-coupled Wide Band Amplifiers," Proceedings of the IRE, October, 1945.



Three views show construction of converter unit.

these voltages may be obtained from most receivers.

The power supply used has one disadvantage in that the chassis is connected to one side of the a.c. line. This is no problem however, if care is taken to insert the power plug with the proper polarity, so that the grounded side of the line is connected to the chassis.

It is possible to eliminate this danger if no actual ground returns are made to the chassis, or if the chassis is insulated from the case. It was not felt however that these additional measures were necessary as, once installed, the converter would not be disturbed.

Construction details of the converter may be seen by examining the photographs. A 7" x 7" x 2" cadmium plated chassis is used, and the completed unit mounted in a 7" x 8" x 7" deep cabinet.

The tuning condenser C_2, C_3 is a dual *Cardwell* "Trimair," with each section of 10 $\mu\mu$fd. maximum capacity. This condenser is centered on the chassis and mounted by means of the brackets furnished with it. The base for the plug-in coils is mounted on two inch ceramic standoffs close to the left hand side of the condenser to insure that the leads to the coil be as short as possible.

The filament transformer T_1 is located at the right rear corner of the chassis. The selenium rectifier is mounted to the right of the tuning condenser, with the dual filter condenser mounted between it and the panel.

The bracket to the left of the coil mounting, is a frame from a defunct filter choke. This bracket measures 2¼" high, 2½" long, and is 1¼" in width. A similar bracket may be constructed from scrap metal. Sockets for the two tubes are mounted on the top portion of this bracket, and the output i.f. transformer L_3, L_4 is located on the rear vertical portion of the bracket. This method of construction insures that all r.f. leads are of minimum length. Although tube shields are shown, their use is not necessary, and some expense may be saved by their elimination.

The i.f. transformer L_3, L_4, is constructed on the form from a defunct i.f. transformer. This transformer is one of the small type sold for replacement purposes, and uses a coil form ⅜" in diameter. One of the ceramic trimmers used in the original transformer, plus a 100 $\mu\mu$fd. mica, are used to tune the primary coil L_3. Checking the original trimmer condenser on a condenser bridge indicated that the maximum value was approximately 100 $\mu\mu$fd. Any trimmer of this approximate value may be used in its stead.

The output winding L_4 is of relatively low impedance, and will give a good energy transfer to the majority of surplus receivers. In the event that one of the standard communications receivers is used, it would be advisable to increase the number of turns on L_4 to give a better match to the approximately 300 ohm input circuit of most receivers.

The r.f. tube is the one located closest to the front panel. The combined mixer-oscillator is mounted to the rear to give short leads to the i.f. transformer. The tube sockets should be oriented to give the shortest leads to the tuning condenser and coil base.

An insulated flexible coupling is used between the shaft of the tuning condenser and the tuning dial. This is necessary, as the shaft of the tuning condenser is "hot" with r.f. on the six meter band. In spite of the short leads, there is considerable inductance in the condenser plates and shaft.

As the antennas used at this location for six and ten meters are both fed with 52 ohm coaxial line, the input to the cathode circuit of the r.f. stage is loaded with a 47 ohm re-

(*Continued on page* 139)

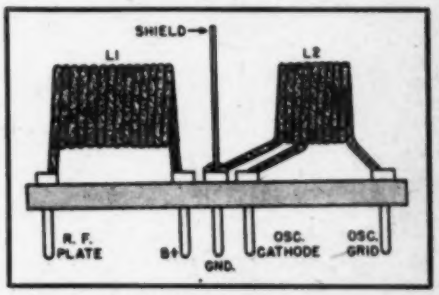
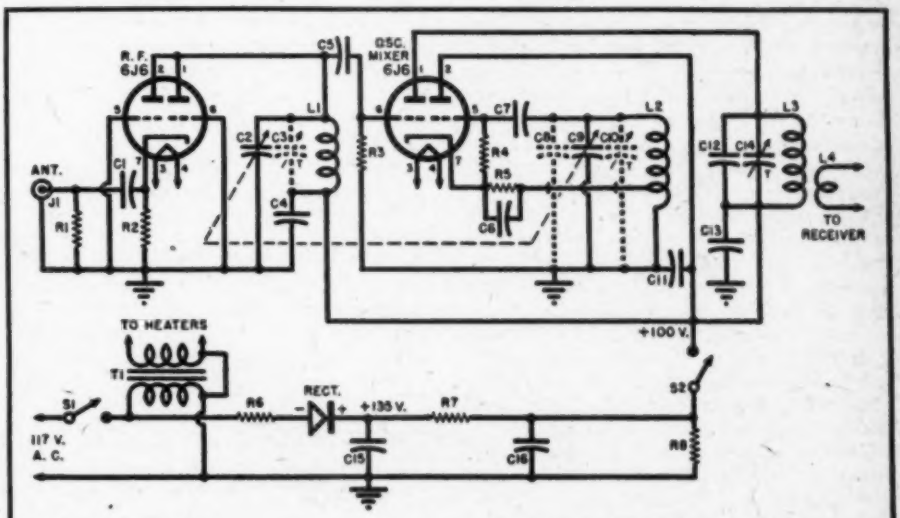


Fig. 1. Mechanical construction of coils L_1 and L_2. Two sets of coils are required to cover the 6, 10, and 11 meter bands.

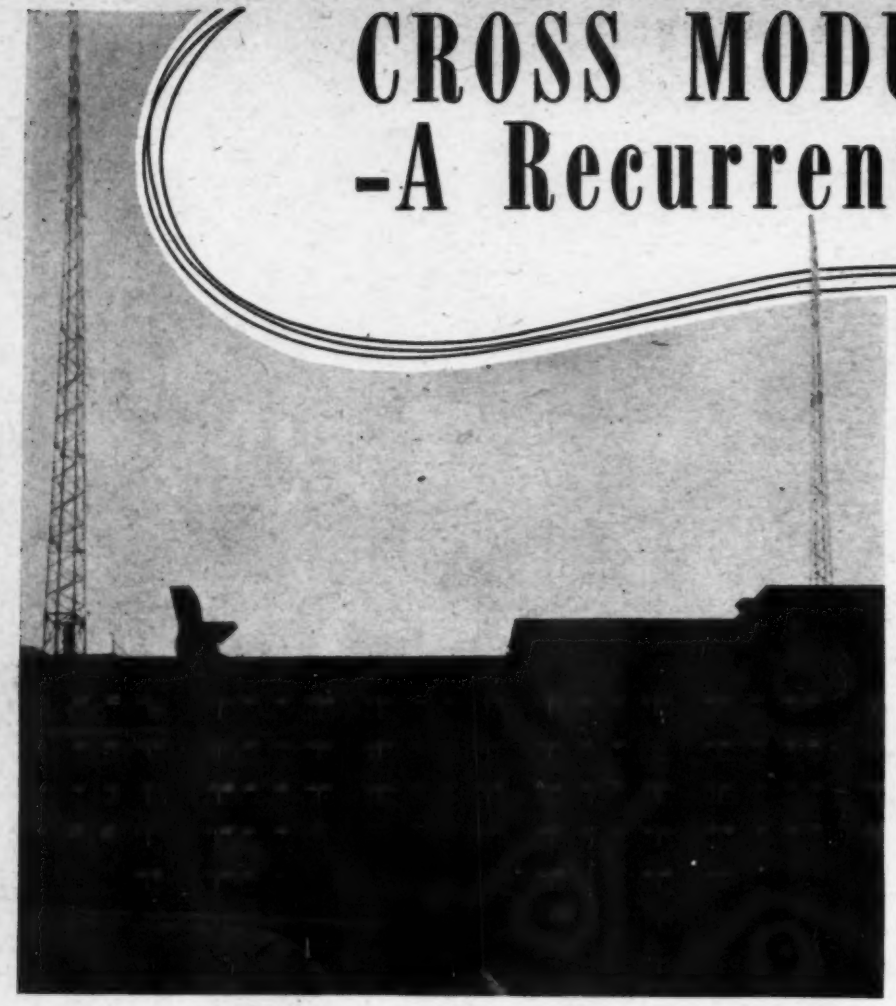
Fig. 2. Complete schematic diagram of self-powered converter.



R_1—47 ohm, ½ w. res.
R_2—68 ohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4, R_5—47,000 ohm, ½ w. res.
R_6—470 ohm, ½ w. res.
R_7—40 ohm, 1 w. res.
R_8—1750 ohm, 10 w. res.
C_1, C_4, C_6, C_{11}, C_{13}—.002 μfd. postage stamp mica cond.
C_2, C_5—10 $\mu\mu$fd. dual var. cond. (Cardwell ER10AD)
C_3, C_{10}—3-30 $\mu\mu$fd. trimmer (see coil table)
C_7, C_8—50 $\mu\mu$fd. silver mica cond.
C_9—20 $\mu\mu$fd. zero coefficient ceramic
C_{12}—100 $\mu\mu$fd. mica cond.
C_{14}—100 $\mu\mu$fd. trimmer cond.
C_{15}, C_{16}—40 μfd., 150 v. elec. cond.
L_1, L_2, L_3, L_4—See coil table
T_1—Fil. trans. 6.3 v. @ 1 amp.
S_1, S_2—S.p.s.t. toggle sw.
Rect.—100 ma. selenium rectifier
J_1—Input jack
2—6J6 tubes

CROSS MODULATION -A Recurrent Factor

By
JOHN B. LEDBETTER
Eng., WKRC, WCTS-FM, Cincinnati



Multiple-dwelling installations, especially when located near transmitter sites, are often plagued by cross-modulation interference. One corroded connection in an installation can cause cross-modulation in a number of receivers.

This type of interference is one of the most difficult encountered by servicemen. Here is one way of locating the source of the trouble.

CROSS-MODULATION (sometimes called "cross-talk") is defined as "a kind of intermodulation in which there are produced frequencies equal to the sums and differences of a desired and an undesired frequency, or of their harmonics." Thus cross-modulation or "station riding" is a condition wherein two or more broadcast stations can be heard on the same frequency (or frequencies). This type of radio interference is caused by electrolytic impressions arising from special conditions and should not be confused with adjacent channel, blanketing, or heterodyne interference.

Cause of Cross-Modulation

It is common knowledge that the junction of two dissimilar metals sets up a chemical reaction or electrolysis which, in turn, produces a minute voltage between the two dissimilar elements. When this voltage is the result of electrolytic action between a suitable rectifying agent and a radio signal of sufficient field intensity, a condition of non-linearity between current and voltage is set up and cross-modulation may occur. Cross-modulation is not dependent entirely on the distance of a radio receiver from the stations involved, its action being influenced more by local conditions than by relative field intensities. In fact, many of the most prevalent cases of interference are encountered in areas of very low field strength.

Cross-modulation is not a new kind of radio interference. Detailed reports and studies were made of this phenomena as far back as 1935 and in such metropolitan areas as San Francisco, New York, Chicago, Los Angeles, and Cincinnati. Several general remedies were found and recommended, and the majority of interference complaints were eliminated. As a result of the present upsurge in the broadcast industry, however, with subsequent licensing of new stations and the granting of power increases to others, radio servicemen and station engineers will undoubtedly be faced with recurrent and increasing complaints of cross-modulation, especially in metropolitan areas where considerable amounts of exposed electrical wiring, metallic surfaces, and other rectifying media are encountered. Cross-modulation effects are also present in some rural areas, particularly those in the vicinity of high-powered broadcast transmitters. This latter condition is duplicated in metropolitan districts where the transmitter is located in or atop a business or hotel building.

Analysis of Cross-Modulation

Since cross-modulation is produced by a non-linear current-voltage condition, the frequencies and side-frequencies capable of carrying cross-modulation can be found mathematically but this problem is of little more than academic interest to the serviceman.

Cross-modulation is of the same order as the fundamental, and hence may be used in locating and eliminating the source of cross-modulation. (It should be noted that these side frequencies are not developed by the presence of a second harmonic, but may be generated *without* the existence of a second harmonic of *any* kind.)

Table 1 is included in the hope that it may be useful as a reference in compiling specific interference frequencies in your own locality.

Sources of Cross-Modulation

It has been stated before that cross-modulation is a product of electrolysis between two dissimilar metals. It can also be caused by corrosion or oxidization at the juncture of two *similar* metals. Any such juncture which forms a low-impedance path to ground for the radio signals is a potential source of cross-modulation. A few cases have been found wherein cross-modulation was generated within the *receiver*, being due, in some instances, to non-linear action of the tubes, and

(*Continued on page* 154)

CONVERSION NOTES on the BC-696-A

By JOHN T. FRYE, W9EGV

Fig. 1. Top view of the power supply control box with the BC-696-A in the background. The switches on the front from left to right are: filament control switch; the switch controlling the relay, K_{III}, used for cutting the final on and off; and the plate-power switch. Next is the key jack and to the right of this jack is the opening that gives access to the modulator jack. The shoulder-type fiber washer which serves as an insulating lining for this port can also be seen in the photograph.

Complete details for converting a popular war surplus item. It can be used as a v.f.o., high power exciter, or as a c.w.-phone transmitter.

THE BC-696-A and its brother members of the 274-N family constitute some of the most popular war-surplus items with the amateur fraternity. A large part of this popularity is due to the ease with which these sturdy, frequency-stable little units may be converted to various amateur uses, such as v.f.o.'s, NBFM exciters, or complete c.w.-phone transmitters.

It is the purpose of this article to point out some of the conversion methods that have proved satisfactory and to give a detailed description of the particular method worked out by the author after extensive experiments. The reader will thus be in a position either to imitate the author's methods or to make such variations on this procedure as are dictated by his tastes and the equipment on hand.

First, let us glance briefly at the transmitter as designed by *Western Electric* for the Signal corps. Fig. 2 shows the diagram of the BC-696-A which is common to all of the transmitters of the series. The legend employs the original designation of *Western Electric* as to resistors, condensers, etc.

The transmitter consists of a 1626 master oscillator driving a pair of 1625's in parallel. Inductive coupling is used between the grid circuit of the oscillator and the grid circuit of the final. The 1625's are neutralized. Power is taken from the final tank circuit by a rotating variable link, one end of which is grounded to the chassis and the other end of which connects through a variable inductance to the antenna post.

A 1629 eye tube, in conjunction with a sealed 3500 kc. crystal, is used for checking dial calibration. When the transmitter is tuned to other than the crystal frequency, the eye shadow is narrow; but when the frequency of the master oscillator approaches the resonant frequency of the crystal, the shadow angle opens, the widest angle indicating exact resonance. A trimmer, reached through a hole in the top of the transmitter, permits the oscillator to be placed in precise calibration with the dial.

A d.p.s.t. relay, K_{III}, opens the plate lead of the oscillator and the cathode circuit of the final amplifiers—except for a 51,000 ohm resistor—when it is not energized. Another relay, K_{II}, when not energized grounds the output of the transmitter. When both of these relays are energized—they are hooked in parallel—the plate voltage is applied to the oscillator, the cathode circuit of the final amplifier is closed, and the output is connected to the antenna post.

The filaments of the two 1625's are in series across the filament supply voltage, which was 24-28 volts. This condition is also true of the filaments of the oscillator and eye tubes, although a 126 ohm resistor is added to the latter to compensate for its lower filament current rating. Total filament drain was slightly less than one ampere.

Filament voltage, final plate voltage, final screen voltage, and oscillator plate voltage were all introduced through a seven-prong socket in the rear of the transmitter. Another lead to pin #5 permitted the relays to be energized remotely by grounding this lead. This was done so that either of two transmitters mounted in a single rack could be selected for use. All voltages were kept on both transmitters, so when the lead connected to the #5 pin of either transmitter was grounded, that transmitter was placed in action. *K_{II} was not intended,* as many amateurs believe, for a keying relay.

On *"Fone"* the 1625's were screen modulated with another 1625 by means of a modulation transformer. Under this condition, the screen voltage supply was regulated at 150 volts. On c.w. the screens were supplied with 270 volts by a series dropping resistor from the 525 volt output of the dynamotor. This full voltage was applied to the plate of the final, and a voltage divider circuit put 190 volts on the plate of the oscillator.

The transmitter was keyed in the

"B-plus" high voltage lead from the dynamotor. The keying relay thus removed all positive plate and screen voltages from the transmitter when it was opened.

Now that we know something of what the transmitter was intended to do—and no intelligent conversion job can be attempted without such knowledge—we are ready to adapt it to our use. If we convert it into a complete c.w.-phone transmitter, we will doubtless obtain the maximum benefit from the unit for it can still function as a v.f.o. for a higher power stage. Let that be our aim.

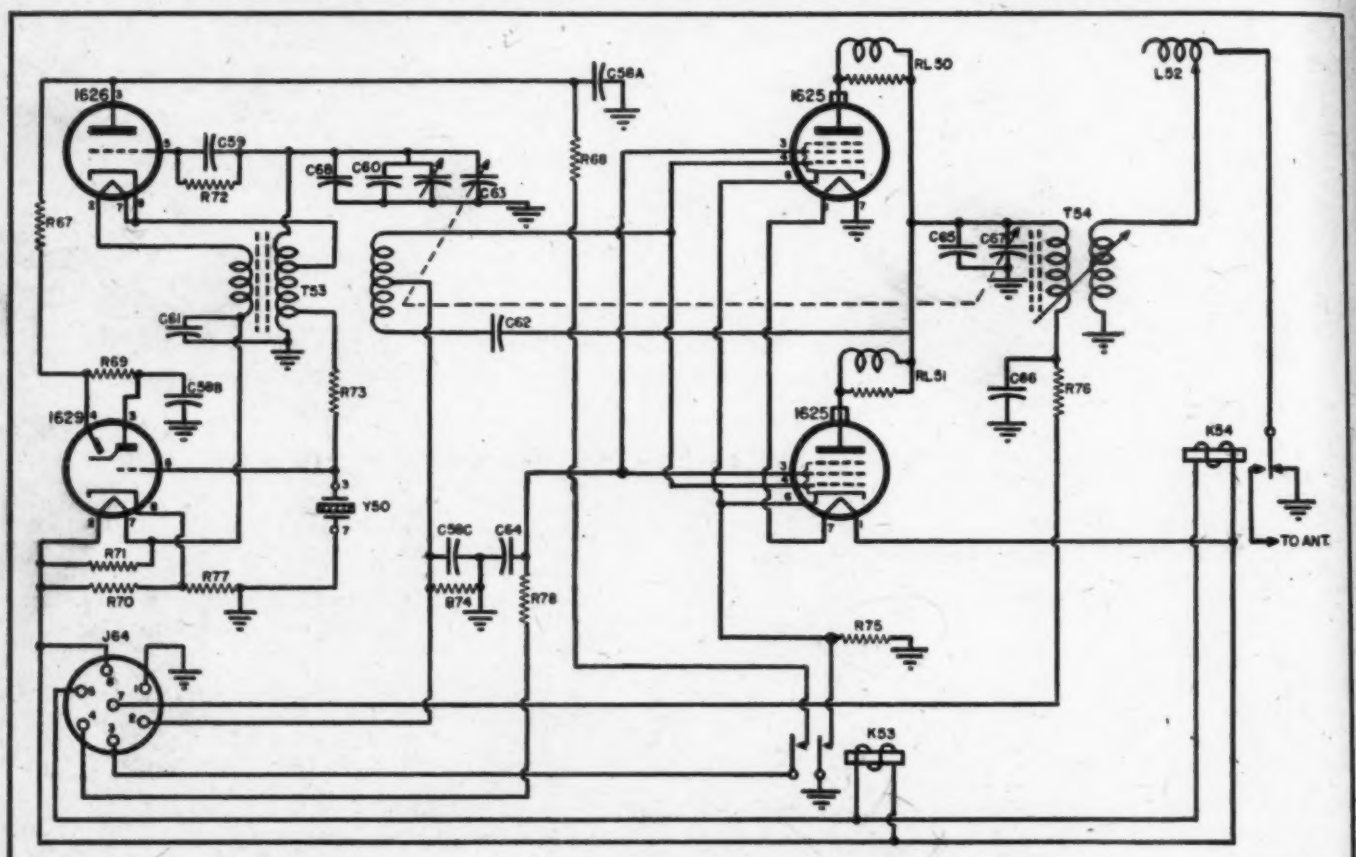
The first consideration is what filament voltage to use. Some amateurs have used step-down transformers in conjunction with dry-disc rectifiers and filters to obtain 28 volts of d.c., but this hardly seems necessary inasmuch as a.c. works just as well on everything except the relays. If the filament circuits are left as is, around 25 volts of a.c. are needed. The filaments can be wired in parallel and a voltage of 12.5 employed. A couple of hardy souls I know substituted 807's for the 1625's, put a 6J5 in the 1626 socket, and applied 6.3 volts to the filaments wired in parallel. They report that a small rat-tail file can be used to slot three of the holes on each 1625 socket so that an 807 can be inserted. The 1629 also works satisfactorily with only 6.3 volts on the filament, although it is a little slow in coming up to operating temperature. Of course, the 1625 sockets have to be rewired to conform with the 807 pin connections.

The author decided upon the 25 volt a.c. method and wound a filament transformer for this voltage along with another 5 volt, 3 amp. winding for a rectifier filament. The high voltage winding was figured to deliver a little more than one ampere of current. The instructions given in the June 1947 issue of RADIO NEWS in the article "Practical Transformer Design and Construction" made this a simple matter.

The power supply pictured and diagrammed (Figs. 4 and 5) was then built up. This supply delivers around 500 volts under load and has no detectable hum or ripple when used on the transmitter. The selenium rectifier is used in conjunction with the filament circuit to produce some 18 or 20 volts of d.c. for operating relay K_{53}. The resistors used for obtaining screen and oscillator plate voltages are identical with the values originally specified for this purpose. J_1 is intended for the insertion of modulation. As can be seen from the photograph, it is set back from the front panel on a little piece of bakelite and is reached through a hole that is protected from shorting by an extruded fiber washer cemented into position. This is a safety feature to protect the operator from contact with the high voltage. Other high voltage points above the chassis are heavily taped. It will be noted that when the plug carrying the modulation voltage is inserted in J_1, the screen supply as well as the plate supply of the final is modulated.

J_2 is a keying jack in the "B-minus" lead. It is important to note that the centertap of the high voltage transformer, one side of C_2, and one side of R_2 all connect to a common point other than the chassis and are returned to the chassis only through J_2. PL_1 is a #46 pilot lamp that is used as a cheap fuse. It is good protection for the rectifier and transformer. All voltages are taken out of the rear of the power supply through a large 7-prong socket whose numbering is

Fig. 2. Complete schematic diagram and parts list for the BC-696-A as they appear in their original form. Complete details for converting this unit for various amateur uses are given in the text.



R_{67}, R_{72}, R_{75}—51,000 ohm res.
R_{68}, R_{76}—20 ohm res.
R_{69}—1 megohm res.
R_{70}—1500 ohm res. for BC-696-A & BC-459-A (1000 ohm res. for others)
R_{71}—126 ohm res.
R_{73}—10,000 ohm res. (for BC-457-A); 15,000 ohm res. (for BC-458-A); 51,000 ohm res. (for BC-459-A & BC-696-A)
R_{74}—15,000 ohm res.
R_{77}—390 ohm res.
R_{78}—51 ohm res.
C_{58A}, C_{58B}, C_{58C}—.05/.05/.03 μfd. cond.
C_{59}—.00018 μfd. cond.
C_{60}—M.O. padding cond.
C_{61}—.006 μfd. cond.
C_{62}—Fixed neutralizing cond.
C_{63}—M.O. tuning cond.
C_{64}—.002 μfd. cond.
C_{65}—P.A. padding cond.
C_{66}—.01 μfd. cond.
C_{67}—P.A. tuning cond.
C_{68}—.000003 μfd. cond.
T_{53}—Master osc. trans.
T_{54}—Transmitter output trans.
RL_{50}, RL_{51}—Parasitic suppressor
L_{52}—Ant. tuning inductor
Y_{50}—Crystal
K_{53}—Selector relay
K_{54}—Ant. relay

identical with that on the socket of the transmitter. This makes wiring of the cable connecting the two much more simple than would otherwise be the case.

The sockets seen along the side of the power supply are used as follows: A plug inserted in SO_1 carries 117 volts a.c. to the filament and plate circuits of the modulator and speech supply. The filament primary is connected to the leads from pins 1 and 3; the plate primary from leads 1 and 2. SO_2 is intended to receive a plug carrying a three-wire cable to a pair of remote switches in parallel with S_1 and S_2. The filament switch goes across pins 3 and 4; the plate switch across pins 3 and 2. SO_3 is intended to receive a plug carrying leads to an antenna changeover relay, a send-receive relay and a pilot lamp or other device it is desired to excite with 117 volts a.c. when the plate voltage is turned on. Leads to these relays are soldered into the plug in pairs: 1 & 6, 2 & 5, 3 & 4. Since each socket has a different prong arrangement, it is impossible to insert a wrong plug.

An OD3/VR150 can be inserted in the socket shown in dotted lines in the diagram (Fig. 5) when low output and maximum frequency stability is desired, such as when the unit is being used as a v.f.o. followed by several doubler stages; but it is not necessary when operating on 75-meter phone and should not be used on 80 meter c.w. More on this subject later.

The next step is to make necessary changes in the transmitter itself. First, take out the front window and lift the little spring carrying the antenna relay contact over the top of the portion of the antenna post jutting inside the case. The spring will hold the contact firmly down on top of this post and effectively short out the antenna-connecting contacts.

Next take off the bottom of the case. Cut off the lead going to the #2 connection of the socket on the rear of the transmitter. Simply cut it loose and tuck it back out of the way. This will give you a spare connection for future use. Cut loose from #5 connection the lead running to relay K_{31}. Leave the lead running to K_{33}, which can be seen mounted on the side of the case, connected. Change the lead that runs from K_{33} to the #1 pin of the 1625 farthest from the relay to the #7 pin of the tube nearest the relay.

Remove the lead going to one of the oscillator plate circuit contacts of K_{32} and solder it to the lead going to the opposite contact so as to prevent any opening of the plate circuit by the relay.

Remove R_{70} and R_{71}—each has one end soldered directly to lug # 8 of the eye tube socket—and solder a 2500 ohm, ½ watt resistor in the place of R_{71}. This will prevent the a.c. of the filament circuit from blurring the shadow angle of the eye.

Finally, solder the wires of a seven-wire cable, each wire of which is well-insulated and the filament wires of which are #20 or larger, into the receptacle holes of the socket on the rear of the transmitter. A clamp is used to hold the cable firm against the transmitter case and to prevent any pulling on the soldered connections. On the other end of the cable, solder the wires into the corresponding-number pins of a large seven-prong plug. When this cable is plugged into the socket on the rear of the power supply, the BC-696-A is ready to function.

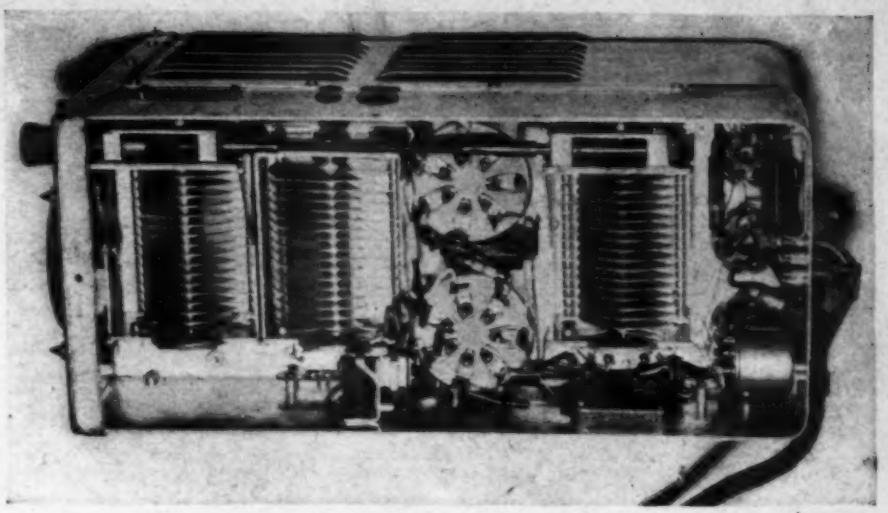


Fig. 3. Bottom view of transmitter. The cathode resistor for the eye tube is shown in front of the black wirewound resistor bolted to the rear of case. The method for attaching and securing the cable is also shown. The selector relay, K_{33}, is shown attached to the side of the case.

S_1, nearest the corner of the chassis, turns on the filaments of the transmitter and that of the rectifier. When S_2, next to it is closed, relay K_{33} closes, shorting out the 51,000 ohm resistor in the cathode circuit of the final amplifier. When S_2 is closed, plate current is turned on. Any time that S_2 is opened it causes K_{33} to open and effectively shuts off the final amplifier, allowing the oscillator to be zero-beat with a signal.

To operate on c.w., simply insert a plug from the key or bug in J_2. Since the transmitter is dead with the key up, break-in operation can be used. Some amateurs are using K_{33} as a keying relay. The author discarded this system for the following reasons: 1. He doubted the relay would stand up long under keying; 2. he did not like the clatter the relay made with the aluminum case as a sounding board; 3. this form of keying resulted in bad clicks which could not be cured because of the lack of room for a key-click filter inside the case. After trying cathode keying of the final, plate-keying of the oscillator in conjunction with cathode keying of the final by

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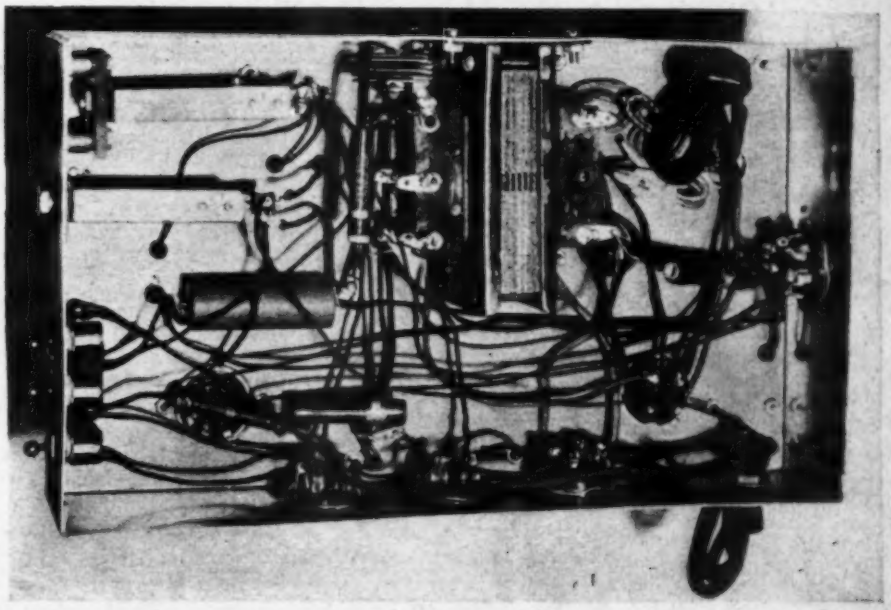
Fig. 4. Bottom view of power supply. The filament transformer is shown bolted to the side. Beside it is the selenium rectifier. The method of insulating the modulation jack is also shown in the photograph.



SPEECH BLOCKADE

By
C. E. ATKINS
Tung-Sol Lamp Works, Inc.

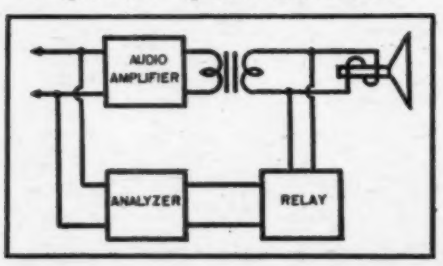
The design and operation of a novel gadget, ideal for the experimenter. Circuit permits discrimination between music and speech in radio programs.

THE radio technician or service engineer with an experimental turn of mind can derive considerable pleasure from the novel control system described in this article. Frequently one desires to listen only to musical programs and to have all speech deleted. This is particularly true when one is compelled to listen to the many programs composed of occasional musical renditions separated by long commercial announcements. Under such circumstances the pleasure obtained by having the announcer's voice automatically fade out approaches ecstasy. Such pleasant results can be virtually achieved, depending in part on the experimenter's ingenuity. It must be definitely understood at the outset that the system described here is not foolproof and does not absolutely eliminate all of the speech while admitting all of the music. When properly constructed and adjusted, it will effectively reduce the quantity of talking that gets through while inadvertently removing a phrase of music now and then. This fact is probably fortunate inasmuch as a completely effective "decommercializer" would raise havoc with the economics of radio broadcasting. Nevertheless some interesting results can be coaxed out of the system and the writer presents it here in the belief that some of the more intrepid of RADIO NEWS readers might care to try their hand at it.

Fig. 1 shows, in outline form, the instrumentalities underlying almost any approach to the problem. Program material from the second detector is fed through the audio amplifier to the output transformer and the speaker voice coil while, concurrently, it is also being fed to an analyzer which determines whether it is speech or music, so as to control a relay accordingly. The contacts of this relay shunt the speaker voice coil so that when the relay is closed the voice coil is shorted and the loudspeaker is not energized. The design of the amplifier may be predicated on any of the known differences between speech energy and music energy. In the present system the difference in the ratio of the peak energy to average energy between speech on the one hand and music on the other is employed. This is graphically shown in Fig. 3, where *A* is an oscillogram of a typical speech passage while *B* is an oscillogram of a typical music passage. It can be seen from this figure that the music energy has a degree of continuity in marked contrast to the intermittent character of the speech energy. A circuit sensitive to this characteristic difference between speech and music energy is utilized to determine whether the relay will short circuit the speaker voice coil.

A simple and effective means for discriminating between the waveform of Fig. 3A and that of Fig. 3B is shown in Fig. 4. Audio frequency energy appearing across a load resistance, R_9, is rectified by the first diode section and appears as a pulsating d.c. potential across the network R_{11}-C_8. Both of these components have relatively low values so that the combination has a small time constant. A relatively large condenser, C_7, is charged through a high resistance R_{10}. In practice C_7 may be .1 microfarad and R_{10} 5 megohms. C_8 is .05 microfarads while R_{11} is 100,000 ohms. Voltages between point "X" and ground can appear and disappear rapidly in responsive conformity to the program waveform. A voltage pattern approximating the envelope of this waveform will appear here. A voltage can develop between point "Y" and ground (across C_7) only very slowly because of the time required to charge C_7 through the relatively high resistance R_{10}. However, the voltage at point "Y" can disappear rapidly because R_{10} is shunted by a thermionic diode (second section of the 6H6) connected in a polarity such that while the charging current for C_7 is compelled to flow through R_{10} the discharge current flows instead through the low resistance of the diode's cathode-anode space.

Fig. 1. Block diagram shows principle of operation of speech blockade circuit.



With a mechanism of this character, intermittent audio energy such as speech is incapable of producing and maintaining an appreciable potential across C_7, whereas music energy, having a more continuous character, is able to charge C_7 and maintain point "Y" at a relatively high and continuous potential. Of course, the magnitude of the energies applied to the network must be kept under control and the writer has found it helpful to use a limiter ahead of the audio frequency rectifier (first section of diode tube). A simple way of doing this is disclosed in the over-all circuit diagram, Fig. 5.

In Fig. 5 audio frequency from the second detector is fed through a separate volume control, provided for the purpose, to the grid of a voltage amplifier. The output of this stage is applied to a driver which, in turn, energizes the mechanism disclosed in Fig. 4. Voltage developed at point "Y" is applied to the grid of a control tube, in the plate circuit of which is a relay. The contacts of the relay are connected across the speaker voice coil so as to short circuit it when the relay solenoid is energized. It is naturally possible to have the relay connected so as to open the voice coil circuit while disabling it if such is desired. An electrolytic condenser (C_9) is shunted across the relay solenoid in order to stabilize its action. It may

also be necessary to shunt the solenoid with a resistor in order to bring its operation within suitable range.

The choice of control tube will depend upon the relay at hand or vice versa. The writer had an old telephone relay in his junk box which would close at 15 ma. and release again at 11 ma. It is shunted by a resistance of 10,000 ohms in order to shift the operating range upward a bit. A 6AQ5, 6V6GT, or 6K6GT triode-connected was found to make a satisfactory control tube with this particular relay. If a more sensitive one is available a tube with a lower plate current, such as a 6SK7GT or even a triode such as a 6C5GT, 6J5GT, or 6P5GT may be used. In the writer's setup with a 6K6GT, approximately 20 volts is required at point *"Y"* in order for the relay to open and the speaker to become operative. At 9 to 11 volts the relay closes again, shorting the speaker voice coil. These voltages must be measured with a high impedance vacuum-tube voltmeter.

The diode sections can be in a single tube such as the 6H6GT or 6AL5. The driver tube in the writer's apparatus was a triode-connected 6SK7GT. A high transconductance triode would probably work just as well. Limiting action is achieved at this point by means of a resistor R_6 in series with the driver grid. Positive excursions of the audio frequency waveform are clipped off due to grid current flow through the resistor R_6. This gives us limiting action on positive swings only but this is sufficient because the cathode of the first diode section is connected to the plate load of the driver tube and only negative swings are rectified by it. Because of the phase reversal in the driver tube, plus direction limiting action is satisfactory. Some a.v.c. is developed by virtue of grid rectification and the time constant of C_4R_5.

In adjusting the control circuit, an oscillograph and a vacuum-tube voltmeter are very helpful. The writer also found that phonograph records aided greatly at this point. Two turntables were set up, one playing a musical recording while the other was rendering a political speech. A switch was provided for quickly changing from one pickup to the other. The control unit and an audio frequency amplifier and speaker were simultaneously fed energy from one or the other of the records. By adjusting the volume control R_1 while switching back and forth between music and speech, a level will be found where the music will develop a sufficiently sustained voltage at point *"Y"* so as to reduce the plate current of the control tube enough to de-energize the relay, thus removing the short circuit from the speaker voice coil. Speech energy, on the other hand, will not, as a rule, be sufficiently continuous in its character to do this. While the limiting action previously described helps to compensate for variations in program levels, reasonably close attention must be paid to the setting of the volume control R_1.

When using the control unit with a radio receiver, audio frequency energy may be picked up at any convenient point ahead of the output while the relay contacts are, of course, connected across the speaker voice coil. If the receiver's a.v.c. is not flat in its action a different setting of R_1 may be indicated when different stations are being received. As stated in the beginning of this article, a control system of this kind is not perfect in its action, as occasional musical passages will be missed and now and then an unwanted word or phrase of speech will slip through. In the writer's experience piano solos got the least favorable treatment as far as music is concerned. And, of course, the device is not very much protection against singing commercials.

Devices of this kind are capable of

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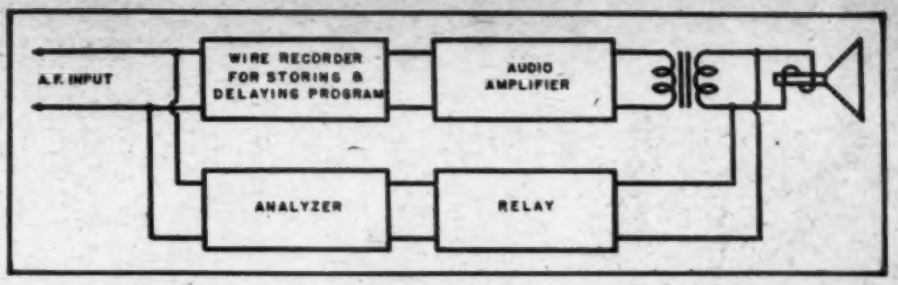


Fig. 2. Block diagram shows functional operation of a more refined circuit. Program material is stored for a more accurate analysis of its voice or music contents.

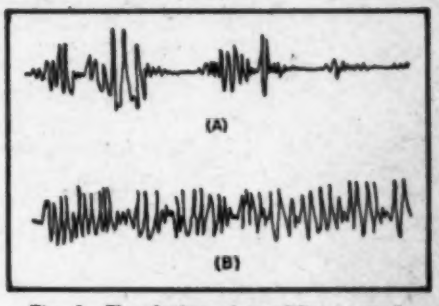


Fig. 3. The design of amplifier is predicated on known differences between speech (A) and average music energy (B).

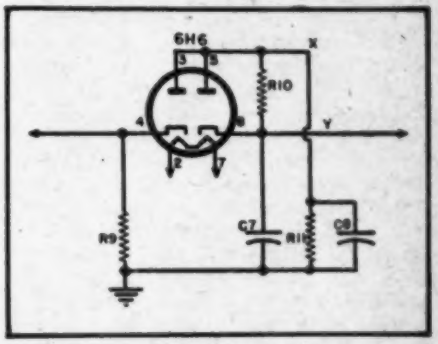
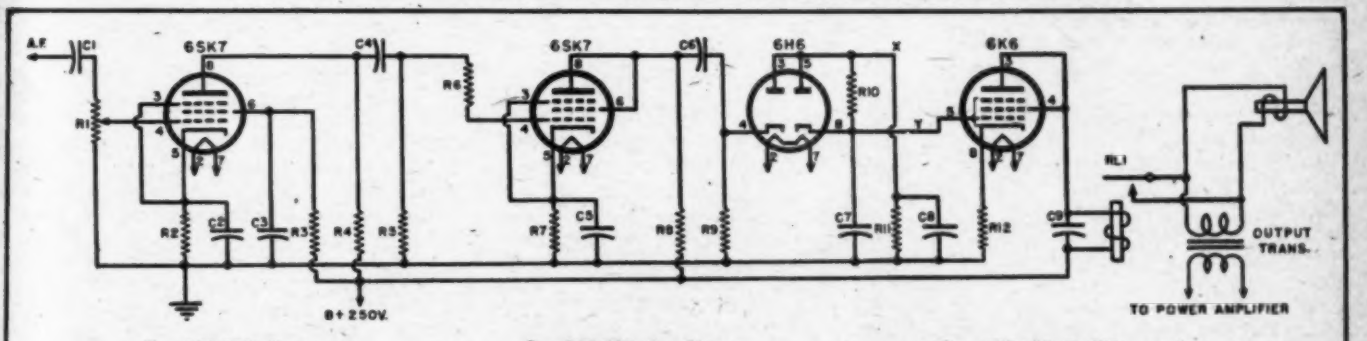


Fig. 4. Basic circuit used to discriminate between voice and music waveforms.

Fig. 5. Over-all circuit of speech blockade system incorporated in a standard home receiver.



R_1—500,000 ohm. pot.
R_2—300 ohm, ½ w. res.
R_3—200,000 ohm, ½ w. res.
R_4—67,000 ohm, ½ w. res.
R_5—300,000 ohm, ½ w. res.
R_6, R_8—50,000 ohm, ½ w. res.
R_7—570 ohm, ½ w. res.
R_9—250,000 ohm, ½ w. res.
R_{10}—5 megohm, ½ w. res.
R_{11}—100,000 ohm, ½ w. res.
R_{12}—100 ohm, 1 w. res.
C_1—.01 μfd. @ 400 v. cond.
C_2, C_3—10 μfd. @ 25 v. elec. cond.
C_4, C_5—4 μfd. @ 450 v. elec. cond.
C_6—.005 μfd. @ 400 v. cond.
C_6—.02 μfd. @ 400 v. cond.
C_7—.1 μfd. @ 200 v. cond.
C_8—.05 μfd. @ 200 v. cond.
RL_1—Relay (See text)
2—6SK7 tubes
1—6H6 tube
1—6K6 tube

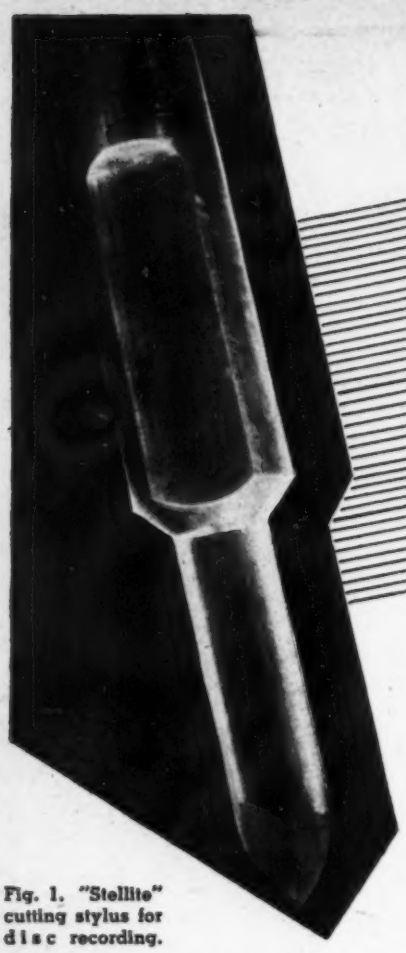


Fig. 1. "Stellite" cutting stylus for disc recording.

The RECORDING and REPRODUCTION of SOUND

By
OLIVER READ
Editor, RADIO NEWS

Part 13. A discussion of the characteristics of cutting styli and conditions governing their proper use.

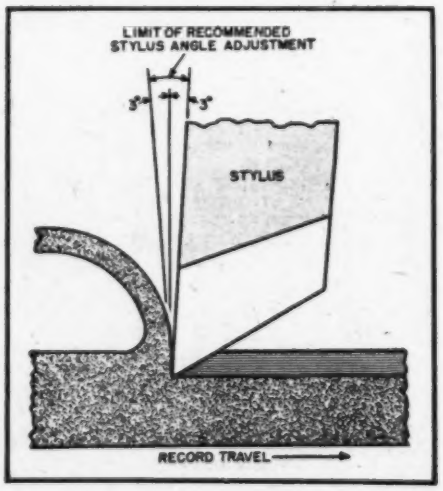
THERE are, in general, three basic types of recording styli in present use. These are: the sapphire, alloy, and steel. The cutting stylus acts in the same manner as does the tool which cuts into material on a revolving lathe. As a matter of fact, the cutting stylus is shaped somewhat like a lathe tool. There is one basic difference, however—the tip of the stylus is the only portion of the assembly which does any actual cutting. For that reason, only the tip need be of hardened material. Normally the stylus cuts a groove in the record of approximately .003 inch in depth. Obviously only that part of the stylus within .003 inch of the tip is subjected to wear. The remainder of the stylus is known as the shank. This is the supporting and enclosing medium which serves merely as the connecting link between the cutting head armature and the portion of the stylus which does the cutting.

It is of major importance that standards be met when manufacturing a stylus for the recording of a sound track in a disc. Not only must the cutting edges of the stylus tip be extremely sharp and free from imperfections, but the sides of the tip must be polished to a very smooth surface. If the cutting edges are not sharp the chip will literally be torn from the blank instead of being cut with a clean stroke as illustrated in Fig. 2. The result will be a groove that is noisy. If the sides of the stylus tip are not polished, groove and stylus cuts will be rough and these will cause undue noise in the recording. Therefore, the groove, after being cut by the stylus, should actually shine (Fig. 4). This indicates that a properly polished and sufficiently sharp stylus has been used. A dull finish on the sides and bottom of the groove indicates that a stylus has been used which is unduly worn or which is otherwise defective.

Most recorders today, except for the inexpensive home recorders, employ a sapphire cutting stylus. These require a high degree of workmanship. If the stylus is inaccurately ground and improperly polished it will not give good results. In fact, results will be inferior to those achieved with a new steel stylus of quality manufacture.

The cutting life of a stylus depends upon several factors; first, the hardness of the material on the blank and second, the lineal velocity of the record groove. For example, a stylus will cut longer when cutting twelve inch records at 33⅓ r.p.m. than when cutting the same diameter at 78 r.p.m. This is because the heat generated at the stylus tip becomes greater as the speed increases.

Fig. 2. Stylus angle adjustment.



Sapphire styli may be made from the genuine gem or from synthetic sapphire (aluminum oxide). The gem sapphire is slightly more expensive but will have longer cutting life before requiring repolishing and resharpening. Both genuine and synthetic styli of this type take a high polish, a feature which is of extreme importance. They both have a low coefficient of friction and are very hard.

Sapphire styli may be resharpened many times and will give many hours of trouble-free service. Because of this long life and because they can be resharpened at a fraction of their initial cost, these styli are no more expensive to use than other types. The chief disadvantage is their fragility. The sapphire is quite brittle and very hard. This means that the tip of the sapphire can be easily chipped. A dulled sapphire can be resharpened but a chipped one cannot. When chipping occurs, the stylus must be discarded.

The tiny tip material is enclosed and mounted in a tubular metal shank. The mounting of these tiny points is extremely critical. There must be no side play, that is, the stylus tip must be firmly embedded into the shank where it cannot assume any motion other than that presented from the armature in the cutting head. The better the bond between the shank and stylus tip, the better

will be the high frequency response. The sapphire must, accordingly, be handled with great care. To accidentally drop the stylus onto a disc is disastrous. Chances are the tip will be ruined.

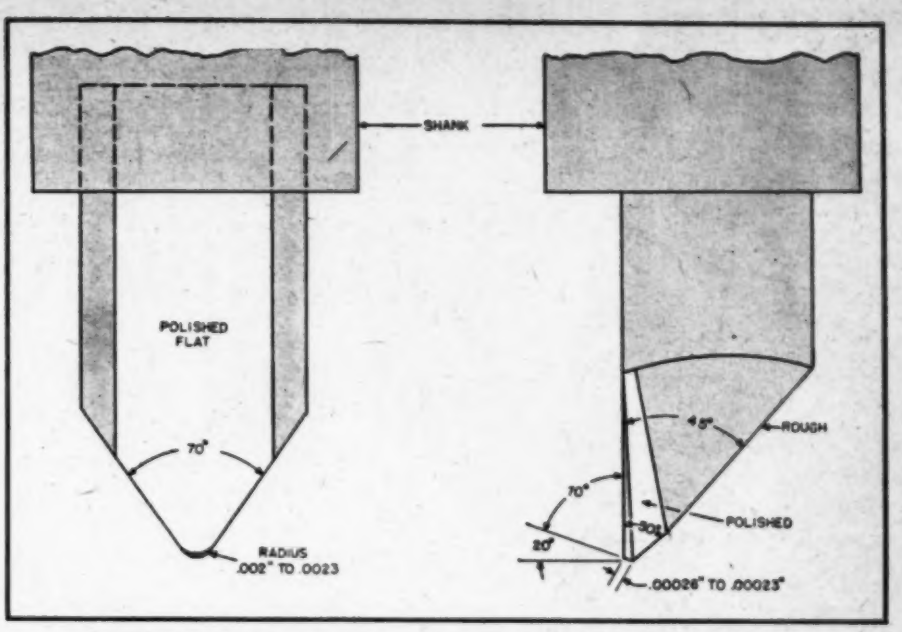
A tremendous strain is placed upon the edges of the recording stylus as it cuts the record groove. The amount of surface noise will depend largely upon the ability of the stylus to retain a sharp edge. In other words, the sharper the edge, the quieter will be the resulting recording. If the edges are dull, the result will be a tearing of the disc material in the groove and the background noise will increase materially. It is, therefore, highly important that the cutting edges be extremely sharp in order that all high frequency undulations be properly impressed on the groove walls. The humps in the vibration waves will vary according to frequency. The low notes or tones will have humps which appear farther apart within the groove than will the high frequency tones or notes. This condition is aggravated where high frequencies appear at low record groove diameters. This is still another reason for using only the best material for the cutting stylus. Furthermore, if sharp edges are not retained, the soft plastic material on the disc will tend to flow instead of being cut properly. Such a condition will result in a recording which sounds mushy or distorted.

Various attempts have been made, some with great success, to develop a cutting stylus making use of an alloy. Usually these styli have a brass or dural shank and only the tip is of the cutting alloy. Some of these styli, using hard material, will last almost as long as a good sapphire. The cost is considerably less however. The chief disadvantage is that these styli have considerably more surface noise than the sapphire and therefore most of the more popular alloy tipped cutting styli employ a metal somewhat softer than the sapphire in order to facilitate proper shaping of the tip and to thereby obtain a lower coefficient of friction. One of these is known as a *"Stellite"* which is tipped with a metal bearing that name (see Fig. 1). It is capable of cutting records for approximately two hours. It may be resharpened for about one-half the cost of a new unit. There is little or no danger of this type of stylus chipping, which is the main reason for its popularity. It is particularly well suited for the home recordist as the hazards of ruining a good cutting stylus are greatly reduced. There are many alloy materials employed for a cutting stylus. These are known as "precious metal tipped styli." One is about as good as another and, as previously mentioned, they are ideally suited to the home recordist.

Steel Styli

The most inexpensive material to use for a cutting stylus is ordinary hard polished steel. There is little hazard from damage when employing such styli. Their life is extremely limited and, figured on a service-per-hour basis, steel styli are actually more expensive than sapphires. They cost from about twenty-five cents to seventy-five cents each and have a useful life of approximately thirty minutes.

For the first few seconds they will possess a very sharp, keen cutting edge. However, they dull quickly and the recording gradually becomes quite



Essential dimensions of sapphire cutting stylus used for lateral recording.

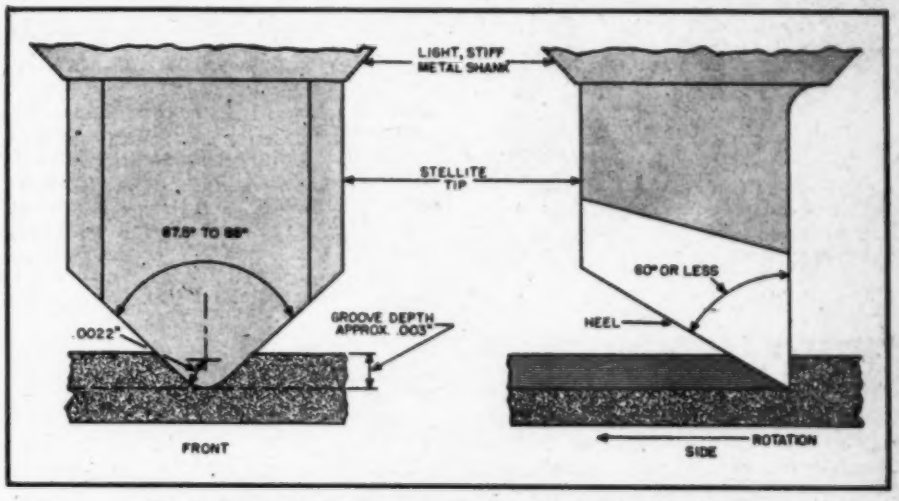
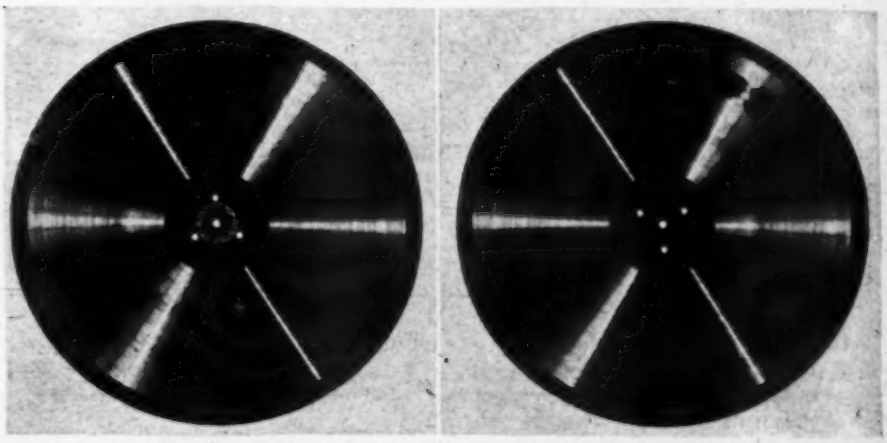


Fig. 3. Essential dimensions for steel or "Stellite" cutting stylus.

Fig. 4. Record cut with new stylus (left). Effects of cutter bounce (right).



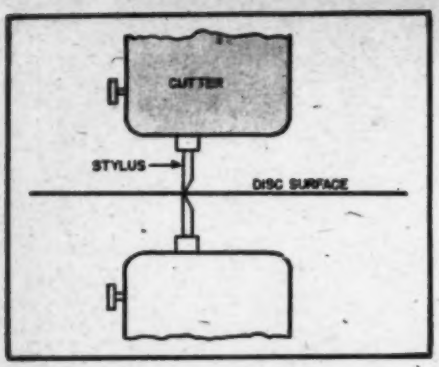


Fig. 5. Correct cutting angle of a stylus may be checked by viewing the reflection of the cutting stylus on the shiny surface of an uncut blank when the turntable is in a stationary state.

noisy. The response of a steel stylus is not as good as a sapphire and it is not capable of engraving the high notes comparable to a sapphire. However, the response is sufficiently good to handle speech and general home music where the highest overtones are not appreciated. Steel styli cannot be resharpened or polished and must be discarded after about thirty minutes of use.

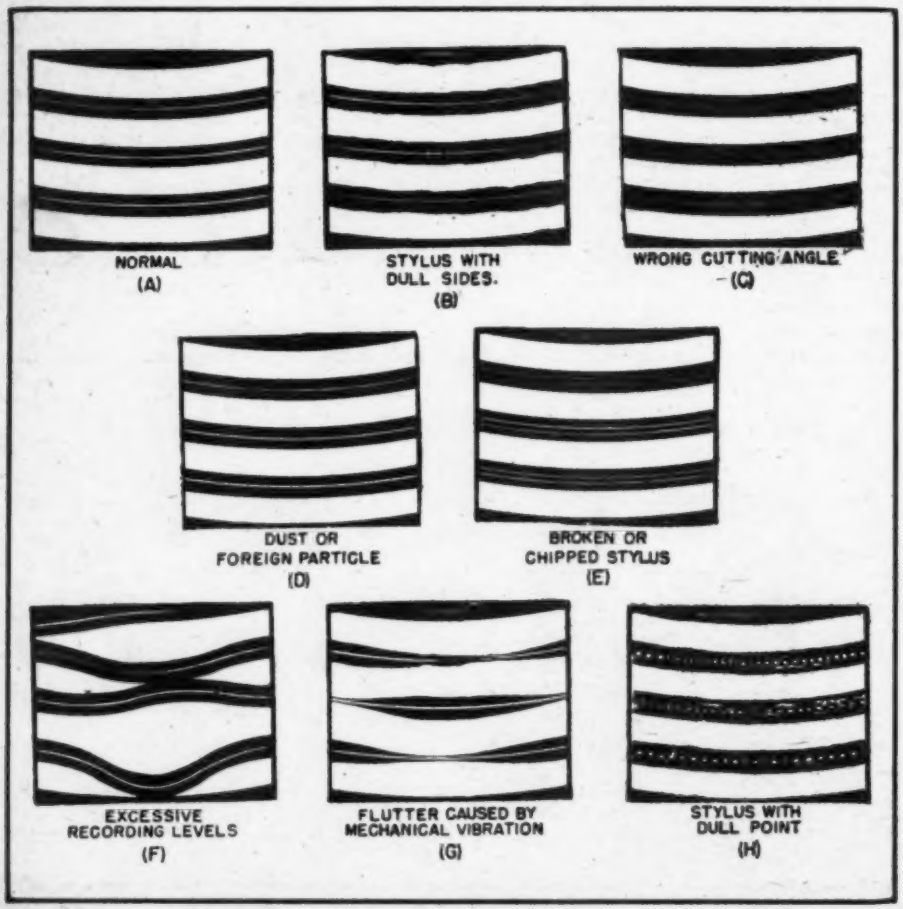
Cutting Angle

The correct cutting angle for the stylus will depend upon the type of head used, the type of material being cut, and the angle on the face of the cutting stylus. If the cutting angle is not correct, there will be an appreciable increase in surface noise. In addition, difficulty will be encountered in controlling the thread or chip as it leaves the record from the cutting process. The result will be high surface noise and squeaking. Many recordists prefer a slight "dig in." This means that the cutting face of the stylus leans slightly forward. Others insist the best results can be obtained only when a slight amount of "dig out" is employed, that is, when the cutting face leans slightly backward from vertical. There is no specific rule of thumb for the correct cutting angle of the stylus. The correct position can be most accurately determined only by cut and try. A test record should be cut without modulation. The unmodulated grooves should be shiny and free from any dullness when viewed in direct light. The record may be played back with a known quality reproducing stylus and the listening test will determine whether or not the cutting has been properly done. If, when played back through an amplifier, there is undue hiss, noise, or squeak on the record it will indicate that an incorrect cutting angle has been employed.

Usually, with good equipment, a correct cutting angle will be found within two or three degrees of a ninety degree vertical. The cutting angle applies whether the cutting face of the stylus leans forward or backward. It does not depend on whether the face is turned one way or another, that is, from side to side. The cutting face of the stylus is pitched slightly as an aid in throwing the chip toward the center of the record. This pitch angle is rarely more than about two degrees. The normal tendency is for the scrap or chip material to fall to the inside of a revolving disc rather than to the outside, therefore, a slight pitch is employed as an aid in steering the chip toward the center of the disc. The cutting angle or angle which the cutting face makes with the surface of the record is checked by viewing the reflection of the cutting stylus on the shiny surface of an uncut blank (Fig. 5) when the turntable is in a stationary position. By looking directly toward the side of the cutter, an imaginary straight line is viewed from the reflection of the stylus both above and below the surface. If there appears to be a continuous straight line, chances are that the stylus is close to the proper vertical position. Any deviation from a straight line will indicate a leaning forward or leaning back of the cutter and its associated stylus. In some cases the cutting face is not parallel to the shank of the stylus. Some manufacturers vary the angle of the face of the stylus considerably. Inasmuch as there are no standards at this writing, no specific stylus can be discussed as being the best suited for general recording purposes. It is well to heed the advice of the cutter manufacturer when selecting styli.

One high quality stylus has a seventy degree angle and employs a short shank. Another has a ninety degree angle and short shank and is recommended for use with a particular cutting head when recording on acetate-lacquer blanks. If a long shank stylus is used, records will be approximately two decibels louder for the same recording level but the frequency response will be poor beyond 8000 c.p.s. and a severe high frequency peak may develop in this region.

Characteristics of recorded grooves. All except (F) have been cut without modulation.



High Fidelity Recording

As mentioned in earlier paragraphs, steel or even tungsten styli can be used but they have a shorter life and are not usually satisfactory for high fidelity work, since in general they produce a groove having a higher noise level. Sapphire styli are recommended for all recording except unimportant tests. A sharp cutting stylus will remove the thread quietly and smoothly. The only noise should be that of the recorder head itself which "talks" audibly during the louder passages. In other words, when test cuts or blank grooves are cut, there should be no tearing or scraping sound. By placing the ear close to the record it is possible to hear the cutting which should sound even in character and have a faint steady hiss. The stylus can be adjusted for minimum noise while operating. The amount of noise heard while cutting a blank groove is a

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THE MINITRAN

By
R. C. AMUNDSEN
W1HYF

Over-all view of completed unit. An external power supply is required.

Easy to build and low in cost, this compact rig is ideal for an emergency or portable transmitter.

MOST ham transmitters are not suitable for strictly portable or emergency operation. They are generally large, heavy, and, most important, inflexible as far as power supply is concerned. To satisfy the requirements for a typical portable and/or emergency transmitter the "MiniTran" was developed on paper and subsequently constructed. Previous attempts at small transmitters using one tube proved the value of a separate crystal oscillator. Too often a one tube transmitter becomes hard to adjust for proper keying, especially when used with makeshift antenna equipment. Therefore, a 6C4 is used in a Pierce oscillator driving a 6AQ5 as an amplifier or a doubler.

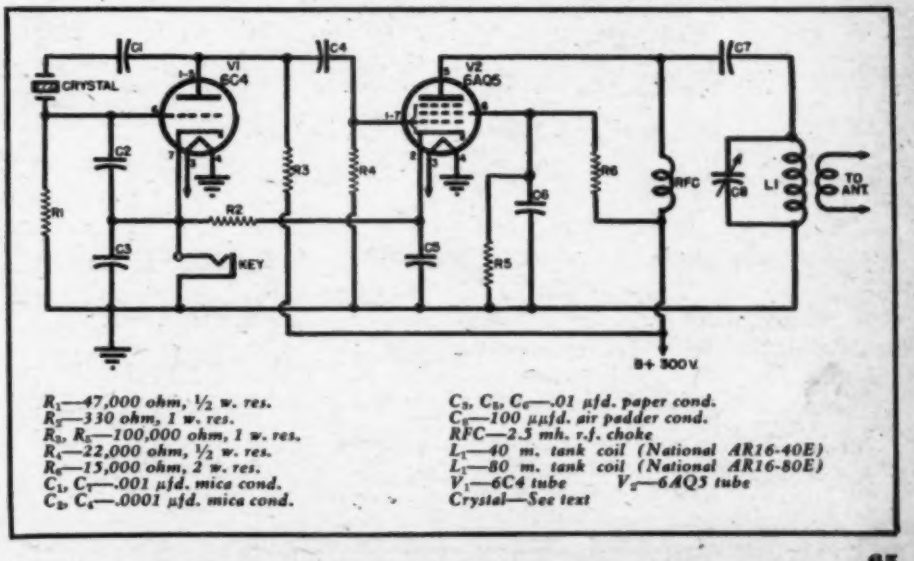
In place of the r.f. choke usually found in the plate circuit of a Pierce oscillator a 100,000 ohm resistor works satisfactorily. This also keeps the plate voltage down to a reasonable value. Protective bias is provided for the 6AQ5 in the form of a 330 ohm resistor in the cathode return. A standard two-circuit jack is provided for keying both cathodes simultaneously. This may also be used to connect a milliammeter to measure the total current of the entire transmitter. Shunt-feed is used in the amplifier so that "B plus" voltage is not exposed on the tank coil. It is to be remembered, of course, that in operation even this small transmitter can yield a nice r.f. burn. By using the two miniature tubes plenty of space is provided on a chassis measuring 5¼"x3"x1¾". In fact, there is room left to add another 6AQ5 as a one-tube modulator. A three-terminal *Jones* male plug is included to make power supply connections. The tank condenser is equipped with a slotted shaft and rarely has to be adjusted in practice even when shifting bands. In fact, because of the untuned Pierce oscillator circuit and just the one tuning control this little rig is capable of changing frequency and bands very rapidly.

A ⅝-inch *Greenlee* chassis punch is almost a necessity when building equipment using miniature tubes. A ¾-inch punch was used to clear the center terminals of the *National* type AR16 coil socket. Two phone tip jacks are used for antenna link connections but small feed-through insulators could have been used as well. The chassis is one of the many small meter cases which have been available from distributors for the last few years.

The power requirements for the "MiniTran" are 6.3 volts a.c. or d.c. at .6 amp and about 300 volts d.c. at about 30 ma. This can be supplied by an ordinary receiver supply or a storage battery and small vibrapack. This rig has been used both on 80 meters and 40 meters and has almost as much output on 40 meters when doubling from an 80 meter crystal as when running straight through. An-

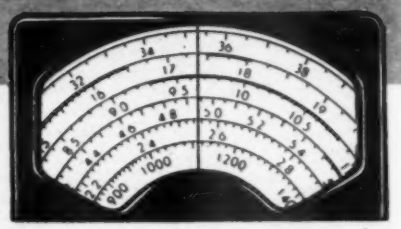
(*Continued on page* 179)

Schematic diagram. A conventional Pierce oscillator is used.



R_1—47,000 ohm, ½ w. res.
R_2—330 ohm, 1 w. res.
R_3, R_5—100,000 ohm, 1 w. res.
R_4—22,000 ohm, ½ w. res.
R_6—15,000 ohm, 2 w. res.
C_1, C_7—.001 µfd. mica cond.
C_2, C_4—.0001 µfd. mica cond.
C_3, C_5, C_6—.01 µfd. paper cond.
C_8—100 µµfd. air padder cond.
RFC—2.5 mh. r.f. choke
L_1—40 m. tank coil (National AR16-40E)
L_2—80 m. tank coil (National AR16-80E)
V_1—6C4 tube V_2—6AQ5 tube
Crystal—See text

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

Concluding the world-wide listing of short-wave stations begun in the February issue. Stations listed cover from 9.475 through 35.000 mc.

WORLD-WIDE LIST OF SHORT-WAVE BROADCASTING STATIONS

*9.475—VONG, St. John's, Newfoundland, 300 w.
*9.480—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
9.480—Moscow.
*9.480—XGOA, Nanking, China.
9.485—CP38, La Paz, Bolivia, "Radio Nacional," 250 w.
*9.490—GWF, London, 50-100 kw.
*9.490—KNBA, Dixon, Calif., U.S.A., 50-100 kw.
*9.490—KNBI, Dixon, Calif., U.S.A., 50 kw.
*9.490—KNBX, Dixon, Calif., U.S.A., 100 kw.
*9.490—WOOW, New York, N.Y., U.S.A., 50 kw.
*9.490—ZBW3, Victoria, Hong Kong.
*9.500—CR6RL, Luanda, Angola, 1 kw.
#9.500—CE950, Santiago, Chile, 5 kw.
*9.500—Paris, "Radiodiffusion Francaise," 100 kw.
*9.500—XKPB, Taiyuan, China, "Shansi Broadcasting Station," 200 w.
9.500—XEWW, Mexico City, Mexico, "La Voz de la America Latinak," 10 kw.
9.500—OAX6D, Arequipa, Peru, "Radio Continental," 300 w.
9.500—Sverdlovsk, U.S.S.R.
*9.500—CR9AA, Macao, Macau, Portuguese China.
9.500V—OIX2, Lahti (Helsinki), Finland, 20 kw.
9.503—KZPI, Manila, Philippines, "Radio Philippines," 250 w.
9.503—Belgrade, Yugoslavia, "Radio Belgrade," 10 kw.
*9.504—OLR3B, Prague, Czechoslovakia, 30 kw.
9.505—CP38, La Paz, Bolivia.
9.505—JVW2, Kawachi, Japan, "N.H.K.," 20 kw.
9.505—HOLA, Colon, Panama, "Radio Atlantico," 20 kw.
9.510—GSB, London, 50-100 kw.
*9.515—XERE, Villahermosa, Mexico, 125 w.
*9.515—KZFM, Manila, Philippines, "The People's Station."
9.515—Geneva, Switzerland, "United Nations' Radio."
*9.515—ZBW3, Victoria, Hong Kong, 2.5 kw.
9.520—VLW7, Perth, Australia, "A.B.C.," 2 kw.
*9.520—La Paz, Bolivia, "Radio Illimani," 250 w.
9.520—Colombo, Ceylon, "Radio SEAC," 1 kw.
9.520—OZF, Skamlebak (Copenhagen), Denmark, 6 kw.
9.520—Paris, "Radiodiffusion Francaise," 100 kw.
*9.520—HEU2, Berne, Switzerland, 25 kw.
9.520V—OAX4K, Lima, Peru, "Radio Central," 200 w.
9.523—Johannesburg, South Africa, SABC (Johannesburg III), 5 kw.
*9.525—Luxembourg, Luxembourg.
9.525—OQ2AA, Leopoldville, Belgian Congo, "Radio Leo," 50 w.
9.525—GWJ, London, 50-100 kw.
9.525—JVU, Nazaki, Japan, 40 kw.
9.525V—ZBW3, Victoria, Hong Kong, China, 2.5 kw.
9.525—WGEO, Schenectady, N.Y., U.S.A., 100 kw.
9.527—Luxembourg, Luxembourg, "Radio Luxembourg."
9.530—VUC2, Calcutta, India, AIR, 10 kw.
*9.530—LKC, Oslo, Norway, 5 kw.
*9.530—Warsaw, Poland, "Polskie Radio," 10 kw.
*9.530—WGEO, Schenectady, N.Y., U.S.A., 100 kw.
*9.530—KNBI, Dixon, Calif., U.S.A., 50 kw.
9.530—KGEI, San Francisco, Calif., U.S.A., 50 kw.
*9.530—Junglinster, Luxembourg, "Radio Luxembourg," 5 kw.
#9.535—XGSG, Nanking, China.
*9.535—JO2L, Nagoya; JO3G, Osaka; JO4F, Hiroshima; JO5C, Matsuyama; JO6H, Kumamoto; JO7G, Sendai; and JO8H, Sapporo, Japan; all 300 w.
*9.535—JZI, Tokyo.
*9.535—VPD2, Suva, Fiji Islands.
9.535—SBU, Motala (Stockholm), Sweden, "Radio Stockholm," 12 kw.
9.535—HER4, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*9.539—HEI4, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
9.540—VE9AI, Edmonton, Alberta, Canada, "Voice of the Great Northwest," 200 w.
9.540—Munich, Germany, 80 kw.
9.540—ZL2, Wellington, New Zealand, "National Broadcasting Service," 10 kw.
9.540—LKJ, Oslo, Norway, 5 kw.
9.540—VLB, Shepparton, Australia, "Radio Australia," 100 kw.
*9.540—VLG2, Melbourne, Australia, "Radio Australia," 10 kw.
9.540—VLR, Melbourne, Australia, "A.B.C.," 2 kw.
*9.540—VLC5, Shepparton, Australia, "Radio Australia," 50 kw.
9.540—OAX5C, Lima, Peru.
8.540—Moscow.
*9.540—XERQ, Mexico City, Mexico, "Radio Continental," 500 w.
9.543—Rangoon, Burma, "Radio Rangoon," 7.5 kw.
*9.545—HED5, Berne, Switzerland, 25 kw.
*9.545—Berlin, Germany.
*9.545—MTCY, Changchun, China.
*9.545—Petropavlovsk, U.S.S.R.
9.547—Komsomolsk, U.S.S.R.
*9.548—Batavia, Java, "Radio Batavia," 3 kw.
9.548—XEFT, Vera Cruz, Mexico, "La Voz de Veracruz," 250 w.
9.550—VUB2, Bombay, India, AIR, 10 kw.
*9.550—Khartoum, Anglo-Egyptian Sudan.
9.550—YDD3, Batavia, Java, "Radio Batavia," 3 kw.
9.550—OLR3A, Prague, Czechoslovakia, 30 kw.
*9.550—GWB, London, 50-100 kw.
*9.550—JO9K, Tokyo, 300 w.
9.550—Paris, "Radiodiffusion Francaise," 100 kw.
*9.550—KGEI, San Francisco, Calif., U.S.A., 50 kw.
*9.550—WGEO, Schenectady, N.Y., U.S.A., 100 kw.
*9.550—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
9.553—XOPB, Hangchow, China, "Chekiang Broadcasting Station," 400 w.
9.557—XETT, Mexico City, Mexico, "La Hora Exacta," 500 w.

*** Station inactive or not heard recently or additional channels of stations currently active on other frequencies.**

 # Stations not on air, including transmitters under construction or installed as projected stations for which official frequency assignments have been made.

"V" Indicates that frequency has been observed to fluctuate considerably.

Note: Wherever possible, the power quoted is the actual operating power which sometimes differs from the licensed power.

To convert frequency (in megacycles) to wavelength (in meters), divide 300 by the frequency.

*9.558—Singapore, Malaya.
*9.560—VLW2, Perth, Western Australia, "A.B.C.," 2 kw.
*9.560—Moscow.
9.560—Paris, "Radiodiffusion Francaise," 10 kw.
9.560—JVW4, Kawachi, Japan, "N.H.K.," 20 kw.
*9.562—FHE4, Dakar, Fr. West Africa, "Radio Dakar," 12 kw.
*9.562—OAX4T, Lima, Peru, "Radio Nacionale del Peru," 10 kw.
9.565—Komsomolsk (Khabarovsk Territory), U.S.S.R., 50 kw.
9.565V—Vienna, Austria, "Rot-Weiss-Rot," 1 kw.
9.570—KWIX, San Francisco, Calif., U.S.A., 50 kw.
9.570—KWID, San Francisco, Calif., U.S.A., 100 kw.
9.570—WRUW, Boston, Mass., U.S.A., 20 kw.
9.570—KZRM, Manila, Philippines.
*9.570—WBOS, Boston, Mass., U.S.A., 50 kw.
*9.570—ZBW3, Victoria, Hong Kong.
*9.575—YSPA, San Salvador, El Salvador, "Le Boz de Cuscatlan," 150 w.
9.575—Salzburg, Austria.
#9.575—Rabat, French Morocco.
*9.580—VLG, Melbourne, Australia, "Radio Australia," 10 kw.
9.580—VLH3, Melbourne, Australia, "A.B.C.," 10 kw.
9.580—GSC, London, 50-100 kw.
*9.580—CR7BE, Lourenco Marques, Mozambique.
*9.580V—Tonkin, French Indo-China, "Voice of Vietnam."
9.582V—CR7BE, Lourenco Marques, Mozambique, "Radio Mozambique," 7.5 kw.
9.585—CE960, Santiago, Chile.
9.590—VUD5, Delhi, AIR, 100 kw.
*9.590—VUD3, Delhi, AIR, 5 kw.
9.590—VUM2, Madras, India, AIR, 10 kw.
9.590—PCJ, Hilversum (Huizen), Holland (Netherlands), "The Happy Station," 60 kw.
*9.590—WLWL, Cincinnati, Ohio, U.S.A., 50 kw.
9.593—CE960, Santiago, Chile, "Radio la Americana," 1.2 kw.
9.595—Athlone, Ireland, "Radio Eirrean," 1.5 kw.
*9.596V—Hanoi, French Indo-China.
9.600—GRY, London, 50-100 kw.
*9.600—Khartoum, Anglo-Egyptian Sudan.
*9.600—Leningrad, U.S.S.R.
*9.600—JZH5, Tokyo.
9.604—HP5J, Panama City, Panama, "La Voz de Panama," 250 w.
9.605—JKE, Yamata, Japan, AFRN, 1 kw.
*9.605—JLP, Tokyo.
#9.605—XGSH, Nanking, China.
9.606—XEYU, Mexico City, Mexico, "Radio Univ. Nacional," 250 w.
9.608—Capetown, South Africa, SABC, 5 kw.
9.610—ZYC8, Rio de Janeiro, Brazil, "Radio Tamoio," 25 kw.
*9.610—CBFX, Montreal, Quebec, Canada, 7.5 kw.
9.610—CHLS, Sackville, Canada, "CBC International Service," 50 kw.
*9.610—Algiers, Algeria.
*9.610—IFD, Rome, Italy.
*9.610—MCH, Luxembourg, Luxembourg.
9.610—XERQ, Mexico City, Mexico, "Radio Continental," 500 w.
9.610—LLG, Oslo, Norway, 7 kw.
*9.610—Moscow.
*9.610—Capetown, South Africa, SABC, 5 kw.
9.615—VLB9, Shepparton, Australia, "Radio Australia," 100 kw.
*9.615—VLC6, Shepparton, Australia, "Radio Australia," 50 kw.

*9.615—VLA2, Shepparton, Australia, "Radio Australia," 100 kw.
9.615—St. Denis, Reunion, "Radio St. Denis," 80 w.
9.620—TIPG, San Jose, Costa Rica, "La Voz de la Victor," 2.5 kw.
9.620—ETA, Addis Ababa, Ethiopia, "Radio Addis Ababa," 1 kw.
‡9.620—Horby, Sweden.
‡9.620—HHK, Port-au-Prince, Haiti.
9.620—Paris, "Radiodiffusion Francaise," 25 kw.
9.620—CXA6, Montevideo, Uruguay, "Radio Electrica," 2 kw.
*9.625—VP4RD, Port-of-Spain, Trinidad, 500 w.
9.625—GWO, London, 50-100 kw.
9.625—XEBT, Mexico City, Mexico, "Radio Pan-Americana," 500 w.
9.630—CP12, La Paz, Bolivia, "Radio Fides," 250 w.
9.630—CKLO, Sackville, Canada, "CBC International Service," 50 kw.
*9.630—XURA, Tai-Pei, Formosa, 3 kw.
*9.630—VUD7, Delhi, AIR, 100 kw.
9.630—VUD10, Delhi, AIR, 20 kw.
9.630—VUD2, Delhi, AIR, 10 kw.
9.630—VUB2, Bombay, India, AIR, 10 kw.
9.630—Milan, Italy, "Radio Italiana," 50 kw.
9.630—VP4RD, Port-of-Spain, Trinidad, 500 w.
9.640—COX4, Havana, Cuba, "Radiodifusora del Ministerio de Educacion," 5 kw.
9.640—GVZ, London, 50-100 kw.
9.640—KZRH, Manila, Philippines, "Voice of the Philippines," 1 kw.
9.640—CXA8, Montevideo, Uruguay, "Radio Real de San Carlos," 3 kw.
9.640—YVKC, Caracas, Venezuela, "Radiodifusora Nacional," 1 kw.
‡9.640—. . . . . Northern Rhodesia.
*9.645—LLH, Oslo, Norway, 5 kw.
*9.645V—CR7BJ, Lourenco Marques, Mozambique.
9.645—Jaffa, Palestine, "Sharq-al-Adna."
*9.648V—VP4RD, Port-of-Spain, Trinidad, "Radio Trinidad," 500 w.
*9.650—CNR3, French Morocco, "Radio Maroc," 2 kw.
9.650—Omdurman, Anglo-Egyptian Sudan.
9.650—KRHO, Honolulu, Hawaii, 100 kw.
*9.650—KCBA, Delano, Calif., U.S.A., 50 kw.
9.650—KNBA, Dixon, Calif., U.S.A., 50 kw.
9.650—WCBN, New York, N.Y., U.S.A., 50 kw.
*9.650—WOOC, New York, N.Y., U.S.A., 50 kw.
9.650—Moscow.
‡9.650—Manila, Philippines.
9.644V—CR7BJ, Lourenco Marques, Mozambique, "Radio Mozambique," 7.5 kw.
9.655—JKF, Nazaki, Japan, "N.H.K.," 5 kw.
9.655—HED6, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
‡9.655—XGSI, Nanking, China.
*9.658—HOXC, Panama City, Panama, "Radio Centroamericana," 7.5 kw.
*9.660—Algiers, Algeria, "Radio Algerie," 10 kw.
9.660—LRX, Buenos Aires, Argentina, "Radio El Mundo," 6 kw.
9.660—VLQ3, Brisbane, Australia, "A.B.C.," 10 kw.
*9.660—GWP, London, 50-100 kw.
*9.660—HHBM, Port-au-Prince, Haiti, "National Broadcasting Co," 1 kw.
*9.660—VUD11, Delhi, AIR, 20 kw.
‡9.660—Jerusalem, Palestine.
‡9.660—Horby, Sweden.
9.660—HVJ, Vatican, City, Vatican, "Radio Vaticano," 25 kw.
9.662V—Vienna, Austria, "Radio Wien," 250 w.
9.663—XGOY, Chungking, China, "Chinese International Broadcasting Station," 35 kw.
*9.665—VLW4, Perth, Australia, "A.B.C.," 2 kw.
*9.665—HEU3, Berne, Switzerland, 25 kw.
*9.666—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
*9.670—OLR5C, Prague, Czechoslovakia, 30 kw.
*9.670—VUD2, Delhi, AIR, 10 kw.
9.670—VUD4, Delhi, AIR, 10 kw.
*9.670—VUD11, Delhi, AIR, 20 kw.
*9.670—VUD9, Delhi, AIR, 7.5 kw.
*9.670—Delano, California, U.S.A., 50 kw.
‡670—WNRX, New York, N.Y., U.S.A., 50 kw.
9.673—Khartoum, Anglo-Egyptian Sudan, "Huna Omdurman."
9.675—GWT, London, 50-100 kw.
*9.675—JVW2, Tokyo.
‡XGSJ, Nanking.
*9.675V—Batavia, Java, 3 kw.
9.680—YDB4, Batavia, Java, 3 kw.
*9.680—VLG8, Melbourne, Australia, "Radio Australia," 10 kw.
*9.680—VLW6, Perth, Western Australia, "A.B.C.," 2 kw.
*9.680—VLA3, Shepparton, Australia, "Radio Australia," 100 kw.
*9.680—VLB2, Shepparton, Australia, "Radio Australia," 100 kw.
*9.680—VLC2, Shepparton, Australia, "Radio Australia," 50 kw.
9.680—Paris, "Radiodiffusion Francaise," 25 kw.
*9.680—VUD2, Delhi, AIR, 10 kw.
9.680—EQC, Teheran, Iran, "Radio Tehran," 14 kw.
*9.680—XUPA (or XURA), Tai-Pei, Formosa.
9.680—XEOQ, Mexico City, Mexico, "La Cadena Azul," 1 kw.
*9.683—HNF, Baghdad, Iraq, 5 kw.
*9.687—TGWA, Guatemala City, Guatemala.
*9.688—Leipzig, Germany.
9.690—LRA1, Buenos Aires, Argentina, "Radio del Estado," 10 kw.
*9.690—HJCAB, Bogota, Colombia, "Radiodifusora Nacional," 2.5 kw.
9.690—GRX, London, 50-100 kw.
*9.690—PLS, Bandoeng, Java.
9.690—Singapore, Malaya, "British Far Eastern Broadcasting Service," 7.5 kw.
*9.694—JVZ3, Tokyo.
9.695—JKG, Kawachi, Japan, "N.H.K.," 5 kw.
9.695—Tananarive, Madagascar, "Radio Tananarive," 300 w.
9.695V—KZOK, Manila, Philippines, "Radio Philippines," "The Voice of the Nation," 250 w.
*9.699—XUPA (or XURA), Tai-Pei, Formosa.
9.700—KCBF, Delano, Calif., U.S.A., 50 kw.
*9.700—KCBR, Delano, Calif., U.S.A., 200 kw.
*9.700—KNBI, Dixon, Calif., U.S.A., 50 kw.
*9.700—WRUS, Boston, Mass., U.S.A., 50 kw.
9.700—WOOW, New York, N.Y., U.S.A., 50 kw.
9.700—WLWS2, Cincinnati, Ohio, U.S.A., 75 kw.
*9.700—Khartoum, Anglo-Egyptian Sudan.
9.700—KZMB, Manila, Philippines.
9.700V—CP25, La Paz, Bolivia, "Radio Sucre," 250 w.
9.700V—Fort-de-France, Martinique, "Radio Martinique," 1.5 kw.
*9.705—KZOK, Manila, Philippines.
9.710—ZQP, Lusaka, Northern Rhodesia, 250 w.
9.710—Moscow.
*9.710—KZPI, Manila, Philippines, 250 w.
*9.715—OLR3D, Prague, Czechoslovakia, 30 kw.
9.715—CR7BE, Lourenco Marques, Mozambique, "Radio Mozambique," 7.5 kw.
*9.720—YAK, Kabul, Afghanistan.
9.720—PRL7, Rio de Janeiro, Brazil, "Radio Nacional," 50 kw.
9.720—Moscow.
9.726V—CS2MF, Lisbon, Portugal, "Emissora Nacional," 10 kw.
9.728—Leipzig, Germany, "Mitteldeutscher Rundfunk," 12 kw.
9.730—CE970, Valparaiso, Chile, "Radio La Cooperativa Vitalicia," 1.5 kw.
9.730—XGOA, Nanking, China, "Central Broadcasting Station," 2 kw.
9.736—Batavia, Java.
*9.740—XGOY, Chungking, China, 35 kw.
*9.740—TI4NRH, Heredia, Costa Rica, "La Voz de Costa Rica," 750 w.
9.740—Moscow.
*9.742—CR6RN, Luanda, Angola, 1 kw.
9.742—CS2MH, Lisbon, Portugal, "Emissora Nacional," 10 kw.
9.745V—OTC2, Leopoldville, Belgian Congo, "Radio Nationale Belge," 50 kw.
9.750—XMRA, Lanchow, China, "Kansu Broadcasting Station," 1 kw.
*9.750—KCBA, Delano, Calif., U.S.A., 50 kw.
9.750—KCBR, Delano, Calif., U.S.A., 200 kw.
*9.750—KCBF, Delano, Calif., U.S.A., 50 kw.
*9.750—WNRI, New York, N.Y., U.S.A., 50 kw.
9.760—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
*9.760—Pietermaritzburg, South Africa, SABC, 500 w.
9.760—Moscow.
*9.763—Khartoum, Anglo-Egyptian Sudan, "Huna Omdurman."
*9.765—OAX4K, Lima, Peru.
*9.775—XOPD, Hangchow, China.
9.780—Moscow.
9.785—Leopoldville, Belgian Congo.
9.790—Menado, Celebes.
9.790—Moscow.
*9.790—TGWA, Guatemala City, Guatemala.
*9.800—HNF, Baghdad, Iraq.
*9.810—XGOY, Chungking, China, "The Voice of China," 35 kw.
9.815—OAX5C, Ica, Peru, 150 w.
9.820—XGOE, Kweilin, China, "Kwangsi Broadcasting Station."
9.825—GRH, London, 50-100 kw.
9.830V—COBL, Havana, Cuba, "Radio Cadena Suaritos," 1 kw.
*9.845—Barranquilla, Colombia, "Emisora Atlantico."
*9.850—HJAP, Caragena, Colombia, "Radio Colonia."
*9.860—EAQ, Madrid, Spain, "Radio Espana," 20 kw.
*9.860—Sverdlovsk, U.S.S.R.
*9.865—CR7BE, Lourenco Marques, Mozambique, "Radio Mozambique," 7.5 kw.
*9.865—Moscow.
*9.865—PLU, Dojakjakarta, Java.
9.870—Johannesburg, South Africa, SABC (Johannesburg IV), 1 kw.
*9.880V—KWS1, Vienna, Austria.
9.890—HJAP, Cartagena, Colombia, "Radio Colonial."
*9.897 5—KROJ, Los Angeles, Calif., U.S.A.
*9.900V—XOPB, Hangchow, China.
‡9.910—Bathurst, Gambia.
*9.912—Johannesburg, South Africa, SABC (Johannesburg IV), 1 kw.
9.915—GRU, London, 50-100 kw.
9.917—XDY, Chapultepec, Mexico, "Radio Mex," 20 kw.
*9.920—Madrid, Spain, 40 kw.
9.924—XDY, Chapultepec, Mexico, "Radio Mex," 20 kw.
9.930—HJAQ, Cartagena, Colombia, "Radio Miramar."
9.935—SVM, Athens, Greece, 7 kw.
9.935—Barranquilla, Venezuela.
*9.940—CS2MI, Lisbon, Portugal, "Emissora Nacional," 5 kw.
9.940—Mexico City, Mexico, "Radio Gobernacion."
9.943—HNF, Baghdad, Iraq, 5 kw.
*9.960—ZAA, Tirana, Albania, 3 kw.
9.964—HCJB, Quito, Ecuador, "La Voz de los Andes," 1.5 kw.
*9.975—HBL2, Geneva, Switzerland, 40 kw.
9.984—Brazzaville, French Equitorial Africa, "Poste Nationale Francaise," 500 w.
*9.995—XGOL, Foochow, China, "Fukien Broadcasting Station," 20 w.
10.000—WWV, Washington, D.C., U.S.A., Bureau of Standards, 9 kw.
*10.000—Vienna, Austria.
10.058—SUV, Cairo, Egypt, "Radio Cairo," 10 kw.
10.062—PLY, Bandoeng, Java, "Radio Omroep Bandoeng," 1 kw.
*10.080—YVKC, Caracas, Venezuela.
10.100—WDF2, San Juan, Porto Rico.
10.105—DTSP, Germany.
10.120—XBHX, Mexico City, Mexico.
10.135—HH3W, Port-au-Prince, Haiti, "Columbia Broadcasting System," 500 w.
*10.140—OPM, Leopoldville, Belgian Congo, "Radio Congo Belge," 7 kw.
*10.143—Geneva, Switzerland.
‡10.145—Geneva, Switzerland.
10.169—Hanoi, French Indo-China, "Radio France."
10.175—SUR2, Cairo, Egypt, 10 kw.
10.200—Hanoi, French Indo-China.
10.205—Moscow.
10.220—PSH, Rio de Janeiro, Brazil, 12 kw.
*10.220—XRRA, Peiping, China.
*10.220—XLRA, Hankow, China.
*10.230—Moscow.
10.258—XRRA, Peiping, China, "Peiping Broadcasting Station," 10 kw.
10.260—PMN, Bandoeng, Java, "Radio Resmi Bandoeng," 500 w.
10.275—Menado, Celebes.
10.275V—. . . . . U.S.S.R., "Espana Independiente."
10.280—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
*10.285—ZNR, Aden, Arabia.
10.300—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
10.310—Clandestine Basque, "Radio Euzkadi."
*10.315—HCHAC, Guayaquil, Ecuador.
10.330—LPC, Ushuaia, Tierra del Fuego, Argentina.
*10.338—HEO4, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
10.350—LQA5, Buenos Aires, Argentina, 10 kw.
10.365—PLS, Batavia, Java, "Radio Batavia," 3 kw.
*10.365—HEF5, Berne, Switzerland, "Swiss Broadcasting Corp." 25 kw.
*10.395—HET4, Berne, Switzerland, "Swiss Broadcasting Corp." 25 kw.
10.400—YSP, San Salvador, El Salvador.
*10.405—HED4, Berne, Switzerland, "Swiss Broadcasting Corp." 25 kw.
*10.445—Moscow.
10.535—Tai-Pei, Formosa, 10 kw.
*10.540—Johannesburg, South Africa, SABC (Johannesburg IV), 1 kw.
*10.585—KUIM, Tokyo, Japan.
10.598—ZIK2, Belize, British Honduras, 200 w.
10.605—VPO3, Bridgetown, Barbados, B.W.I.
10.615—Tananarive, Madagascar, "Radio Tananarive."
*10.670—CEC, Santiago, Chile, 2 kw.
*10.680—PLQ, Bandoeng, Java, 1.5 kw.
10.730—VQ7LO, Nairobi, Kenya, 1.5 kw.
*10.770—Leningrad, U.S.S.R.
10.780—SDB2, Motala (Stockholm), Sweden, 12 kw.
*10.810—EPA, Teheran, Iran, "Radio Tehran," 14 kw.
*10.865—CR6RH, Luanda, Angola.
10.940—FTH, Paris, 30 kw.
*10.940—Moscow.
*10.953—CR6RB, Benguela, Angola, 50 w.
10.970—PZR, Paramaribo, Surinam, "Avros, Paramaribo," 750 w.
11.000—YHN, Djokjakarta, Java, "The Voice of Free Indonesia," 2 kw.
*11.002—CR6RC, Luanda, Angola, "Radio Clube de Angola," 500 w.
*11.010—PLP, Bandoeng, Java, "Voice of Free Indonesia," 1 kw.
11.027—CS2MK, Lisbon, Portugal, "Emissora Nacional," 10 kw.
11.034—RWS4, Semarang, Java, "Radio Welvaart Semarang," 100 w.
11.035—CR6RA, Luanda, Angola, "Radio Clube de Angola," 400 w.
*11.040—CS2ML, Lisbon, Portugal, "Emissora Nacional," 5 kw.
11.083—Soerabaja (?), Java, "Radio Omroep Soerabaja," 200 w.
11.084—Makassar, Celebe.
11.090—CS2MB, Ponta Delgada, Azores, "Emissora Regional Acores," 1 kw.
11.100—Semarang, Java.
*11.115—MCH, Luxembourg, Luxembourg.
*11.200—Clandestine Basque.
11.220—Makassar, Celebes.
*11.250—XMAG, Nanking, China.
11.250—. . . . . Indonesia, may be Musantara, "Radio Repoeblik Indonesia."
*11.290V—XMAG, Nanking, China.
*11.315—Moscow.
*11.323—PZR, Paramaribo, Surinam, 750 w.
11.340—Bonne Antarctic Expedition.
*11.402—HBO, Geneva, Switzerland, 20 kw.
*11.405—FGA, Dakar, Fr. West Africa, "Radio Dakar," 400 w.
11.440—PLO, Batavia, Java, "Radio Batavia," 2.5 kw.
11.490—XLRA, Hankow, China, "Hankow Broadcasting Station," 1 kw.
*11.500—ZMB3, Apia, Western Samoa.
*11.516—PZX4, Paramaribo, Surinam, "Avros, Paramaribo," 5 kw.

(*Continued on page* 102)

AUTOMATIC FREQUENCY CONTROL

By
W. H. BUCHSBAUM

Theoretical operation of automatic frequency control circuits used in television receivers.

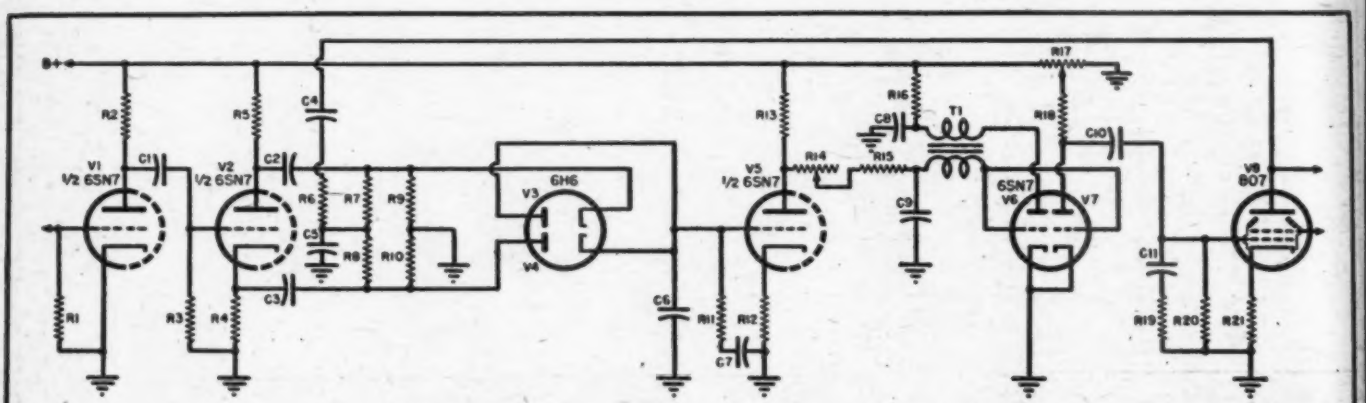
IN ANY television receiver the start of the sweep of the electron beam across the face of the cathode-ray tube is of great importance, since it has to be in exact synchronism with the sweep of the camera at the transmitter. Therefore, along with the television signal, special synchronizing pulses are broadcast to time the sweep at the receiver. We know that the vertical and the horizontal sweeping force is necessary to obtain a picture and that the vertical sweep frequency is 60 cycles-per-second while the horizontal sweep frequency is 15,750 c.p.s. This gives an interlaced picture of 30 frames a second, each containing 525 lines.

Synchronizing pulses are transmitted both at a frequency of 60 c.p.s. and 15,750 c.p.s. and they have to control the saw-tooth frequency of the vertical and horizontal sweep respectively. Moreover, the saw-tooth waves must be generated in such a manner that the longer slope develops during the time between pulses and the shorter slope during the blanking and synchronizing pulses. Fig. 3A shows the picture signal for one complete line, begun and terminated by a sharp pulse, the blanking pulse, which then has another smaller pulse, the sync pulse, superimposed. The blanking pulse drives the grid of the cathode-ray tube negative, cuts off the beam, while the sweep circuits move the beam back from the right hand edge of the screen to its starting position. If the blanking and synchronizing pulse would occur halfway during the sweep from left to right, then the screen would show the end and the beginning of the picture, with a black space in the center, where the blanking pulses cut the tube off. As can be seen from the foregoing discussion a way has to be found to maintain exact synchronism with the incoming synchronizing pulses. This is accomplished by removing the actual sync pulse from the rest of the video signal with a clipper.

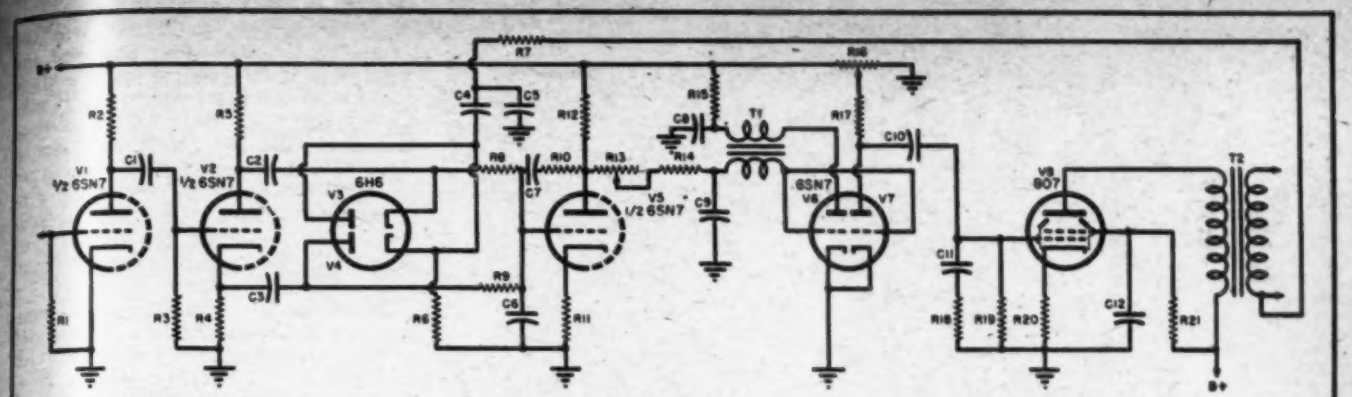
Next, the sync pulse may be amplified and finally it is fed on the grid of the multivibrator or blocking oscillator to trigger that tube. It is then necessary that this saw-tooth generator operate at a frequency very close to that of the sync pulses. This is known as direct sync and is used in most low priced, and in some of the older, television receivers. This system has the disadvantage that an incoming noise is amplified and clipped and will tend to trigger the saw-tooth generator, momentarily forcing it out of sync. The effect on the picture is that of a tear across the screen. Ignition noise and similar electrical disturbances are thus visible and ruin the picture. Another disadvantage is that the horizontal and vertical hold controls require more frequent adjustment to keep the picture stable and standing still.

Automatic frequency control was developed to overcome these disadvantages and to provide a steady clear picture with a minimum amount of adjustment by the user. Several different circuits have been used by manufacturers but they all employ the same basic idea. That basic system requires an electronic means of comparing two frequencies, that of the sync pulses and that of the local saw-tooth generator, and then a means of making a correction in the local saw-tooth generator. A method of comparing two frequencies is found by feeding both signals into a rectifier, one on the plate and one on the cathode. If they are of exactly

Fig. 1.



R_1—5 megohm, ½ w. res.
R_2, R_{15}, R_{19}—50,000 ohm, ½ w. res.
R_3, R_7, R_8, R_{20}—1 megohm, ½ w. res.
R_4, R_9—2200 ohm, ½ w. res.
R_6, R_9, R_{10}, R_{16}, R_{18}—100,000 ohm, ½ w. res.
R_{11}—150 ohm, ½ w. res.
R_{12}—1500 ohm, ½ w. res.
R_{13}—200,000 ohm, ½ w. res.
R_{14}—50,000 ohm rheostat
R_{17}—1 megohm pot.
R_{21}—100 ohm, ½ w. res.
C_1, C_4—1000 μμfd. mica cond.
C_2, C_3—1500 μμfd. mica cond.
C_5—33 μμfd. ceramic cond.
C_6—1 μfd., 200 v. cond.
C_7—40 μfd., 50 v. elec. cond.
C_8—.25 μfd., 400 v. cond.
C_9—820 μμfd. mica cond.
C_{10}—.01 μfd., 400 v. cond.
C_{11}—100 μμfd. mica cond.
T_1—Blocking osc. trans.
1—6H6 tube
1—807 tube
3—6SN7 tubes



R_1—5 megohm, ½ w. res.
R_2, R_{14}, R_{15}, R_{21}—50,000 ohm, ½ w. res.
R_3, R_{17}, R_{18}—1 megohm, ½ w. res.
R_4, R_5—2200 ohm, ½ w. res.
R_6, R_{16}—10,000 ohm, ½ w. res.
R_7—4700 ohm, ½ w. res.
R_8, R_9, R_{13}—100,000 ohm, ½ w. res.
R_{11}—1500 ohm, ½ w. res.
R_{12}—200,000 ohm, ½ w. res.
R_{19}—50,000 ohm rheostat
R_{10}—100,000 ohm pot.
R_{20}—100 ohm, ½ w. res.
C_1—1000 µµfd. mica cond.
C_2, C_5—1500 µµfd. mica cond.
C_4, C_{12}—.1 µfd., 400 v. cond.
C_6—6000 µµfd. mica cond.
C_8, C_{10}—.01 µfd., 400 v. cond.
C_7—1 µfd., 400 v. cond.
C_9—.25 µfd., 400 v. cond.
C_{11}—820 µµfd. mica cond.
T_1—100 µµfd. mica cond.
T_1—Blocking osc. trans.
T_2—Output trans.
3—6SN7 tubes
1—6H6 tube
1—807 tube

Fig. 2.

the same frequency, and provided their waveshape and amplitude is alike, no current can flow through the rectifier and no d.c. voltage is developed. If they are out of phase, then current will flow whenever the plate goes positive and a d.c. voltage will be produced. This voltage will be proportionate to the amount of phase difference as long as one signal is not twice the frequency of the other. The way phase relation of pulses might appear on an oscilloscope is shown in Fig. 3B. The d.c. voltage obtained is often called the "error" voltage and it is applied to the grid of the saw-tooth generator where it adds or subtracts from the bias and therefore has an influence on the frequency of that oscillator. A system such as the one just described has the one fault that the error voltage will be the same whether the saw-tooth generator is too fast or too slow, so that the correction would act in just one direction.

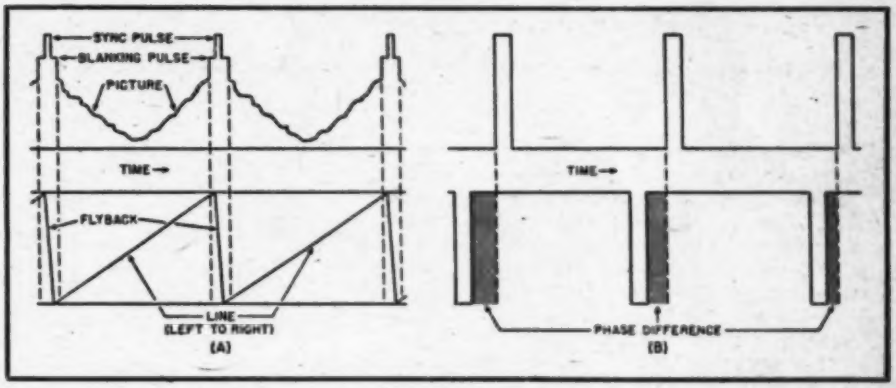
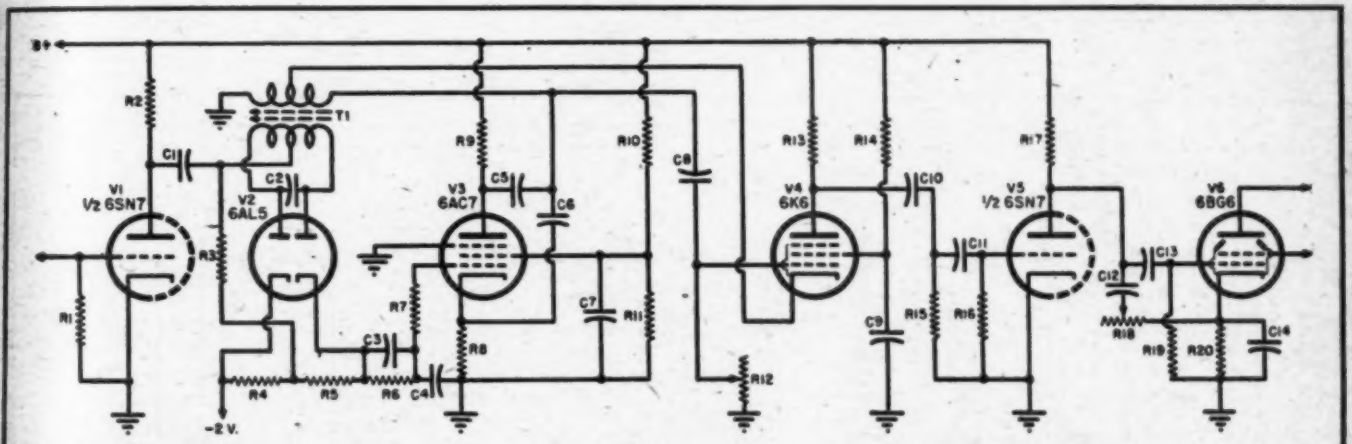


Fig. 3.

A practical automatic frequency control circuit is shown in Fig. 1. Instead of using one rectifier a double diode is employed, and instead of ap-

(*Continued on page* 146)

Fig. 4.



R_1, R_3—1 megohm, ½ w. res.
R_2, R_{13}—3000 ohm, ½ w. res.
R_4, R_5, R_6, R_{19}—470,000 ohm, ½ w. res.
R_7—560 ohm, ½ w. res.
R_8—10 ohm, ½ w. res.
R_9—22,000 ohm, ½ w. res.
R_{10}—39,000 ohm, ½ w. res.
R_{11}—27,000 ohm, ½ w. res.
R_{12}—75,000 ohm rheostat
R_{14}—10,000 ohm, ½ w. res.
R_{15}—6800 ohm, ½ w. res.
R_{16}—220,000 ohm, ½ w. res.
R_{17}—680,000 ohm, ½ w. res.
R_{18}—30,000 ohm rheostat
R_{20}—100 ohm, ½ w. res.
C_1—82 µµfd. mica cond.
C_2, C_6—.015 µfd. mica cond.
C_3, C_5, C_8—4000 µµfd. mica cond.
C_4, C_7, C_9, C_{11}—.05 µfd., 400 v. cond.
C_{10}—390 µµfd. mica cond.
C_{12}—.01 µfd., 400 v. cond.
C_{13}—680 µµfd. mica cond.
C_{14}—1000 µµfd. mica cond.
T_1—Discriminator trans. (See text)
1—6SN7 tube
1—6AL5 tube
1—6AC7 tube
1—6K6 tube
1—6BG6 tube

INTERFERENCE TRAPS for TELEVISION

By

STANLEY N. FINLEY

Fig. 1. Two views of a commercially built interference trap. It is manufactured by Crystal Devices Company.

Some commonly encountered interference problems can be corrected by use of specially built traps.

TELEVISION reception in some localities is disturbed by local FM broadcasts, amateur transmissions, and some commercial or police communication systems.

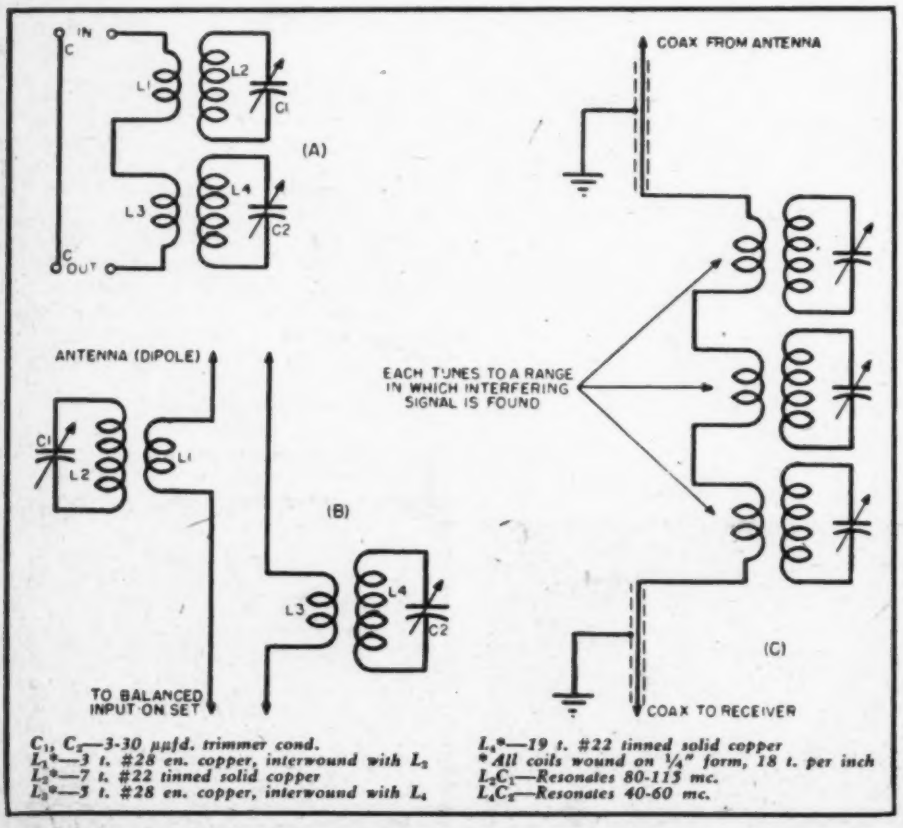
Interference from FM is readily recognizable because it resembles closely the parallel bars of dark and light which experienced televiewers are familiar with as associated sound channel interference. The FM interference pattern can be distinguished from the associated sound channel interference because it bears no relationship to the audible sound, whereas the co-channel sound when it interferes with the picture machines matches the accompanying sound. The photograph, Fig. 5, shows the type of pattern that FM interference produces. The bars move up and down across the picture. The number of horizontal bars per frame varies according to the modulation in the FM signal causing the interference.

Interference from a fixed frequency source will give a fixed pattern, like that of a knitted tie, if it is very strong, or diagonal fine lines, or vertical bars of light and dark, if comparatively weak. An example of this type of interference is illustrated by the pattern of Fig. 7.

These patterns result from the fact that the interfering signal and the video or audio carrier, or the local oscillator mix. Either by addition or by difference this will result in a frequency which falls in the video i.f. channel.

Table 1 shows channels 2-6 of the television bands, the local oscillator frequencies for two types of receivers, and the image response ranges in which the signals from some other service can cause interference with the television image.

To determine the ranges chosen in the tables the following was employed: In Table 1 any listed frequency range when heterodyned with



C_1, C_2—3-30 μμfd. trimmer cond.
L_1—3 t. #28 en. copper, interwound with L_2*
L_2—7 t. #22 tinned solid copper*
L_3—3 t. #28 en. copper, interwound with L_4*
L_4—19 t. #22 tinned solid copper*
**All coils wound on ¼" form, 18 t. per inch*
L_2C_1—Resonates 80-115 mc.
L_4C_2—Resonates 40-60 mc.

Fig. 2. Schematic diagram of several conventional types of interference traps. (A) a commercially available unit. (B) trap designed for balanced input. (C) coaxial connected trap.

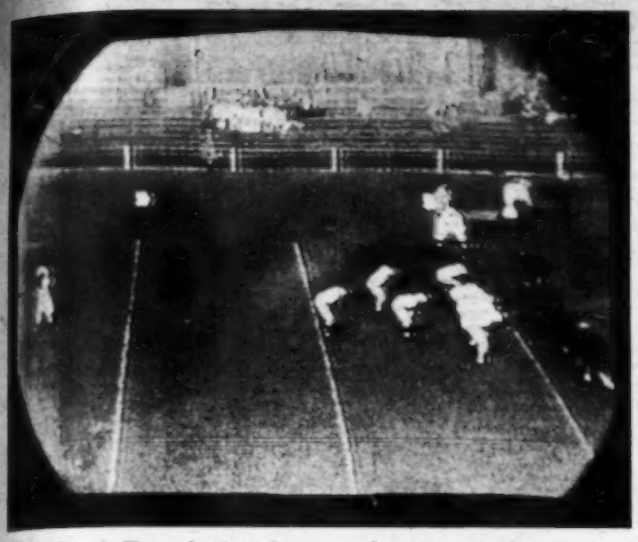


Fig. 3. The reduction of contrast due to an interfering signal. The multiple image at the right of players is due to reflected signals received by the antenna.

Fig. 4. Jose Ferrar as "Cyrano". This shot from the monitor screen shows clearly the effects of video "noise". The mottled appearance is due to "noise" voltages.

the local oscillator will result in video i.f. response. Table 2 gives frequency ranges which, when heterodyned with frequencies in the TV bands, will give a response in the video i.f. bands.

From the tables it can be seen that the most likely form of TV image interference will be that which develops from a strong nearby FM broadcasting station. For example, with a type "A" receiver, an FM station at 98.1 or 98.3 will come right in on the sound channel of a TV receiver, which is tuned to channel 4. On the same channel an FM station on any frequency between 99.1 and 102.9 will probably produce a noticeable response in the video image. Other possible combinations can be determined by referring to the table.

Radiation from the local oscillator of a neighboring television receiver will cause a reduction in contrast in your receiver. In addition, some sort of pattern will be observed on your screen which may vary from parallel vertical or horizontal stripes to a fine pepper and salt combination. Such interference, for example, will result in any type of TV receiver (A or B) when your neighbor with an "A" type receiver tunes in channel 2 while you are tuned to channel 4. Note that the local oscillator frequency for the type "A" set is 68 megacycles on channel 2. This is in the range of channel 4.

CHANNEL (mc.)	LOCAL OSCILLATOR FREQUENCY A*	LOCAL OSCILLATOR FREQUENCY B**	IMAGE BANDS A	IMAGE BANDS B	SERVICES A	SERVICES B
54-60	68 mc.	81 mc.	76-82 mc.	102-108 mc.	TV	FM
60-66	74 mc.	87 mc.	82-88 mc.	108-114 mc.	TV	Comm. Relay
66-72	80 mc.	93 mc.	88-94 mc.	114-120 mc.	FM	Comm. Relay & Aviation
76-82	90 mc.	103 mc.	98-104 mc.	124-130 mc.	FM	Aviation
82-88	96 mc.	109 mc.	104-110 mc.	130-136 mc.	FM	Aviation

*(A) for i.f. frequencies of 8.25 mc. for the audio and 12.75 mc. for the video
**(B) for i.f. frequencies of 21.25 mc. for the audio and 25.75 mc. for the video

Table 1.

These conditions can be corrected by lowering the sensitivity of the input of the set at the frequency which causes the interference. This can be accomplished effectively by means of wave traps. A wave trap may be inserted in series with the antenna, or it may be built into the set as a permanent feature. In some exceptionally interference-full areas it may be advisable to employ both, as was the case in the author's experience.

A wave trap consists of an *LC* circuit of fairly high "*Q*" which can resonate at the frequency it is desired to attenuate. A model is shown in Fig. 1 which employs two tuned circuits, each of which covers a certain range of frequencies. Fig. 2A is a circuit diagram of the dual frequency range trap pictured. A similar arrangement can be made employing several or only one tuned circuit each of which resonates over possible interference ranges.

(*Continued on page* 182)

Fig. 5. Pattern interference caused by transmission from a nearby FM station.

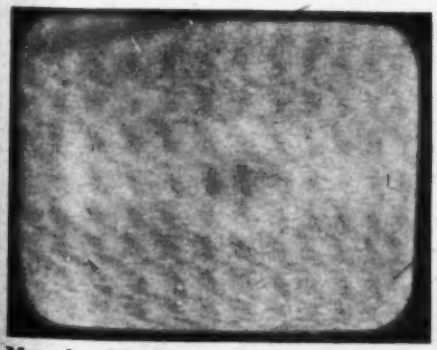


Fig. 6. News photograph of Joe Louis knocking out Billy Conn. Fine pattern results from r.f. of another TV unit.

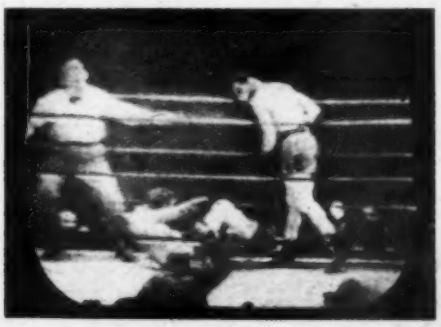


Fig. 7. Beat frequency interference caused by radiation from nearby local oscillator.

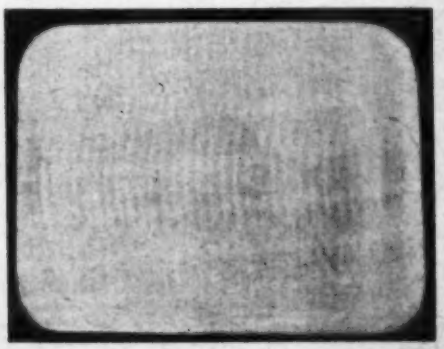


Fig. 1. Conventional high-gain, double-tuned i.f. transformer unit for AM receiver. Note use of fiber lead spacer near bottom.

By ALFRED A. GHIRARDI

Part 60. Concluding article of this series—covering i.f. transformers and their performance in AM, FM, and television home receivers.

MUTUAL inductive (magnetic) coupling is by no means the only method of energy-coupling together the two tuned circuits of a bandpass tuner. Several other methods are possible. Top-end capacitive coupling, as illustrated in Fig. 2A, is often employed.

With "below-critical," or "critical," value of capacitive coupling the overall frequency-response characteristics produced are much the same as for "below-critical" and "critical" magnetic coupling, respectively. This is shown by the response curves for these two conditions in Fig. 2B. However, it will be observed that with "greater-than-critical" capacitive coupling the peaks that are produced are not symmetrically displaced about the resonant frequency of the two tuned circuits. It will be seen that one peak remains approximately on the original resonance frequency for loose coupling, while the second peak appears at a different frequency below this.

Effect of Stray Capacitive Coupling in I.F. Transformers

The conventional circuit diagram of a double-tuned i.f. transformer is as illustrated in Fig. 3A, but actually the circuit of Fig. 3B is more representative of the true conditions which exist, since in an actual tuned transformer unit important condensers (drawn dotted here) are formed by conductors that differ in i.f. potential and which are in close proximity and insulated from each other. The more important of these "stray" capacitances are shown in Fig. 3B and are labeled C_1 to C_5. The photograph (Fig. 1) is that of an actual i.f. transformer mounted with its two trimmer-type tuning condensers C_p and C_s, inside of a shield can, and will help to make clear just how these stray capacitances are set up.

Observe from Fig. 3B that all of the stray capacitances are really in parallel with each other so they add to form a total stray capacitance that is effectively connected from the plate end to the grid end of the transformer, exactly as is condenser C_c in Fig. 2A. This total stray capacitance acts, therefore, to couple the primary and secondary tuned circuits together *capacitively*.

Specifically, the total capacitance that is effective in causing this "capacitive coupling" is composed (as shown in Figs. 3 and 4) of the capacitance C_1 existing between the plate and grid sides of trimmer tuning condensers C_p and C_s, capacitance C_2 between the plate and grid ends of the coil windings, C_3 between the plate and grid leads, C_4 between the grid lead and the plate end of the primary coil, and C_5 between the plate lead and the grid end of the secondary coil. The result is that the coupling between the tuned primary and secondary circuits of the i.f. transformer really consists of both normal *mutual inductance* and top-end *capacitance coupling* effective simultaneously.

This capacitive coupling is a very important part of the coupling existing in practically all i.f. transformers operating at frequencies above about 400 kc. Its importance increases as the operating frequency or the *Q* of the coils is increased, since it then serves to transfer more signal energy from the primary to the secondary circuit. Consequently it is very important to reduce such capacitance coupling in i.f. transformer units that are designed to operate at intermediate frequencies as high as those employed in FM broadcast receivers, television broadcast receivers, etc., by taking all practical steps possible toward that end in the physical design of the individual components, placement of leads, external leads, external shielding, etc., in the assembled coupling unit.

Double-tuned i.f. transformers may be built with the stray capacitive coupling either *aiding* or *opposing* the magnetic coupling[1]. For reasons of production economy, both the multi-layer primary coil and the multi-layer secondary coil are usually machine-wound simultaneously (properly spaced from each other as shown in Fig. 4) on a single dowel or other insulating support. Consequently they must both be wound in the *same direction*. For reasons of production uniformity and to reduce the stray capacitances to minimum values, the *inside* end of each of these multi-layer coils is usually chosen as the "high-potential" (*grid* or *plate*) end of the coil, as shown in Fig. 4. This is done in order to keep these high-potential ends of the coils as far away as possible from; (a) the coil-to-tuning-condenser con-

EDITOR'S NOTE: *With this article we conclude Mr. Ghirardi's popular series which had its beginnings 'way back in February of 1942! Ghirardi fans, of whom there are many, will be happy to know that he will continue to prepare articles for* RADIO NEWS. *This series is, we believe, the longest ever attempted by any national magazine—but because of the important material contained in these articles we feel that our readers were able to add greatly to their knowledge of the "why's" and "wherefore's" of radio.*

[1]Whether the capacitance coupling aids or opposes the magnetic coupling in a given i.f. transformer may be determined by inspection. If the coils are wound in the same direction, which is the usual case, the magnetic coupling opposes the capacitance coupling if both the plate of the preceding tube and the grid of the following tube are connected to the similar ends of the primary and secondary coils (as is the case in the i.f. transformer shown in Fig. 4). Ordinarily, the grid and plate are connected to the inside ends of the two coils, for the "production" and "electrical" reasons stated above.

nection leads that must pass the coils on their way up to the two postage-stamp tuning condensers usually mounted above the coils near the top of the shielding can; (b) the coil-to-receiver hook-up leads that must necessarily pass each coil in order to be brought out through the base of the transformer unit for convenient connection to the tube plate, "B" supply, cathode-return and diode or grid circuits. The stray capacitances (see Fig. 3B), are reduced considerably by following this practice.

If transformers are designed so that the primary and secondary coil coupling is *below* the "critical coupling" value, variations in the stray capacitance coupling are equally important whether the capacitive coupling aids or opposes[1] the magnetic coupling. If they "aid," an increase in the capacitance coupling will raise the gain of the transformer; if they "oppose," an increase in the capacitance coupling will reduce the gain of the transformer (except in the very rare cases where the capacitance coupling predominates).

If the transformer coupling is at "critical coupling" value and the magnetic and capacitance couplings are "aiding," an increase in capacitance coupling will merely decrease the selectivity, while if the couplings are "opposing" an increase in capacitance coupling will increase the selectivity and reduce the gain.

In all of the above cases, the effect of increasing the stray capacitance coupling is pointed out because well-designed i.f. transformers are ordinarily built with a certain irreducible minimum stray capacitance and any changes must necessarily be additions to it.

I.F. Transformer Construction to Maintain Capacitive Couplings Constant

Special precautions and constructions are employed in building well-designed i.f. transformers in order to keep the unavoidable capacitance coupling uniform so that transformers of uniform gain and selectivity characteristics may be provided. In the i.f. transformer unit illustrated in Fig. 1, fiber spacers are used to hold the flexible hook-up leads in the pre-determined fixed position with respect to the coils so that the capacitances between them (see Figs. 3 and 4) will remain of constant value. Some i.f. transformers use a construction employing rigid leads for maximum uniformity of capacity coupling. In each of these transformer units, the pair of small adjustable tuning condensers are mounted above the coil form and inside of the metal enclosing shield can.

In order to take advantage of the uniformity built into i.f. transformers by means of lead-spacers, it is essential that the grid and plate leads remain well spaced from each other at all points. Where the grid lead is brought out through the top of the shield (as in Fig. 1) for convenient connection to the grid cap of the associated i.f. amplifier tube, this is no problem, but in the output transformer for the last i.f. stage, when the high-potential end of the secondary must be connected to a diode it is customary for both plate and diode leads to be brought out through the open bottom of the shield. In such cases, either two separate small holes in the chassis, well spaced, or one large (preferably 1" or larger) hole should be provided so that these leads may be well spaced from each other. In no case should the grid and plate leads be run through one small hole together for appreciable capacitance will then be set up between them.

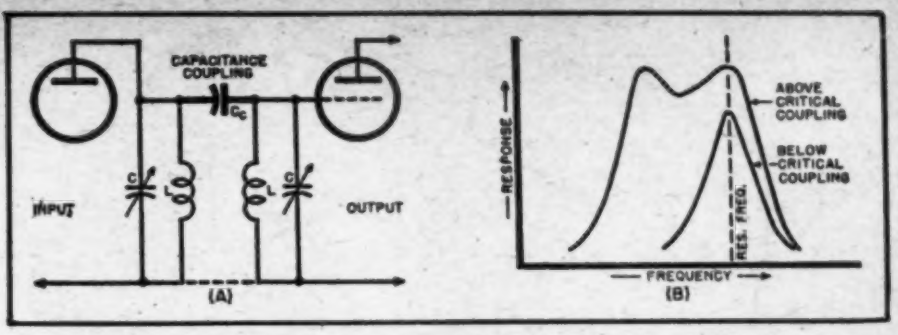


Fig. 2. Top-end capacitive coupling (A) makes the double-peaked, over-coupled resonance characteristic shown at (B) open out to one side of the resonance frequency to which both of the LC circuits are tuned.

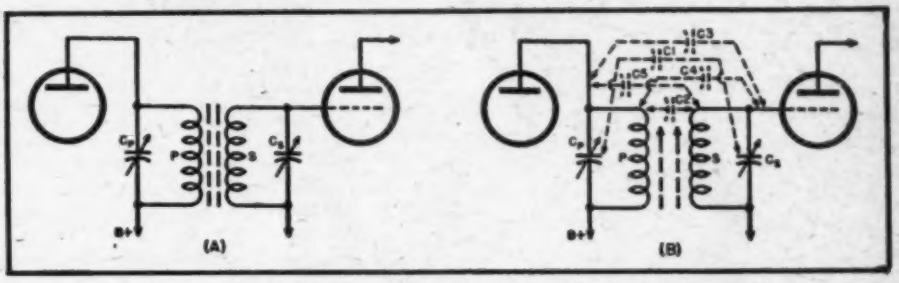


Fig. 3. (A) Typical double-tuned i.f. transformer connected between two tubes, (B) stray capacitances that cause capacitive coupling between the primary and the secondary of the i.f. transformer (see also Fig. 4).

Resistance-Coupled I.F. Stage

Some AM broadcast receivers employ a two-stage i.f. amplifier but use a resistance-capacitance coupling network between the two i.f. amplifier tubes in much the same fashion as a resistance-capacitance coupled audio-frequency amplifier. Such receivers ➡

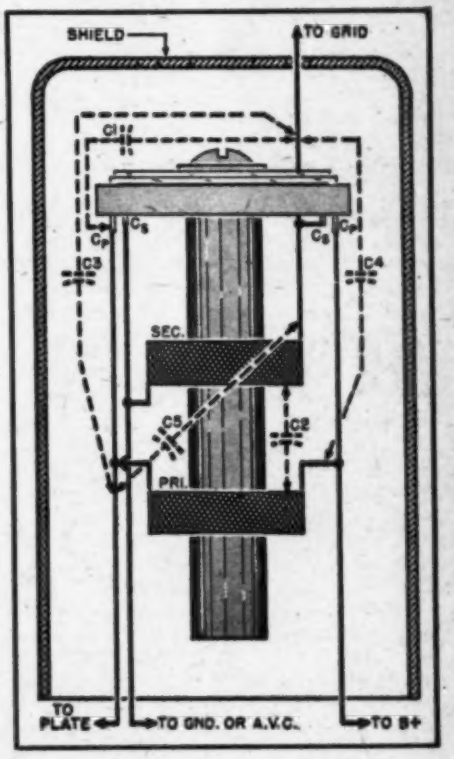


Fig. 4. Arrangement of components and wiring of typical double-tuned i.f. transformer in shield can. Stray capacitances are indicated dotted and are lettered to correspond with those indicated in Fig. 3B.

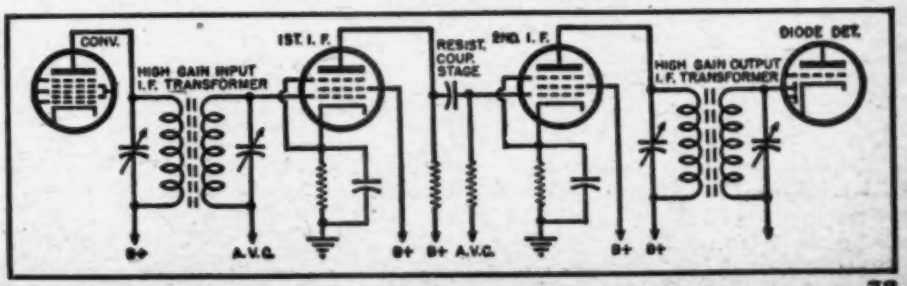


Fig. 5. Use of resistance-coupled i.f. stage in battery portables and farm radios.

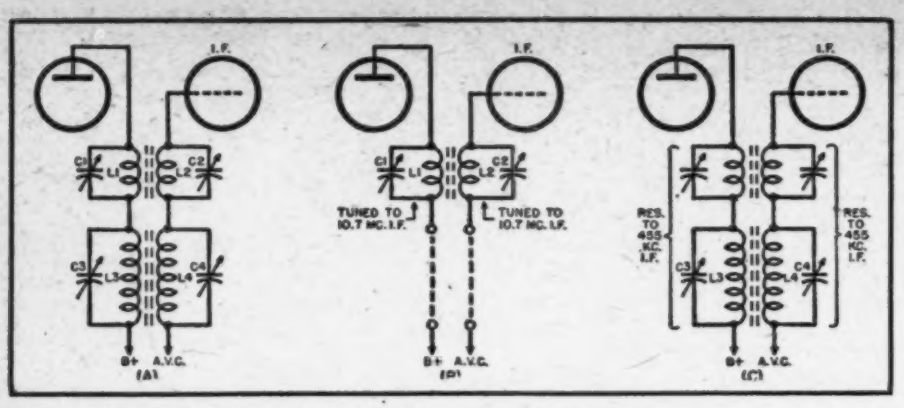


Fig. 6. Circuit and operation of AM/FM i.f. amplifier stage employing combination type AM/FM coupling transformers.

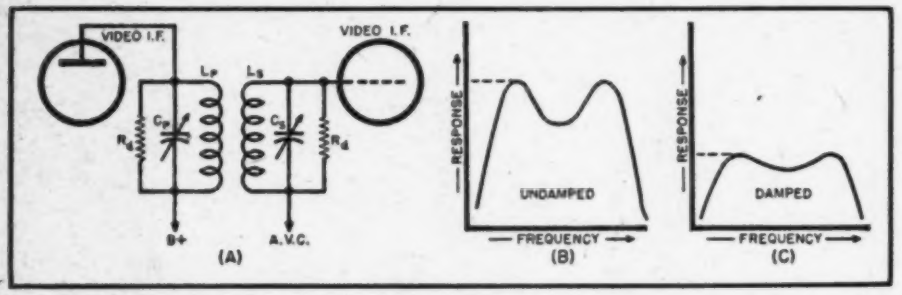


Fig. 7. Use of damping resistors (R_d) in video i.f. amplifiers to flatten out the peaked response produced by high degree of overcoupling used in i.f. transformers.

employ high-gain, double-tuned input and output i.f. transformers. The resistance coupling contributes nothing to the selectivity of the i.f. amplifier, but the resistance-coupled stage does contribute a gain in the order of 15 to 20 times depending upon the tube used, the constants of the circuit, and the applied voltages. As this gain remains uniform over the entire tuning range of the receiver (because the carrier frequency of the signal in the i.f. amplifier does not change), it is preferable to the use of a resistance-coupled r.f. stage, whose gain would vary from one end of the tuning band to the other. (However, use of a resistance-coupled r.f. stage offers an improvement in the signal-to-noise ratio over that of a resistance-coupled i.f. stage.)

The use of a resistance-coupled i.f. stage became popular with the advent of battery portable receivers, farm receivers, and others in which added sensitivity is required to provide adequate performance in rural areas quite removed from the broadcast transmitters serving them, for in these areas such receivers are not apt to be subject to image-frequency signals of sufficient strength to cause image-frequency interference.

Combination I.F. Transformers for AM/FM Receivers

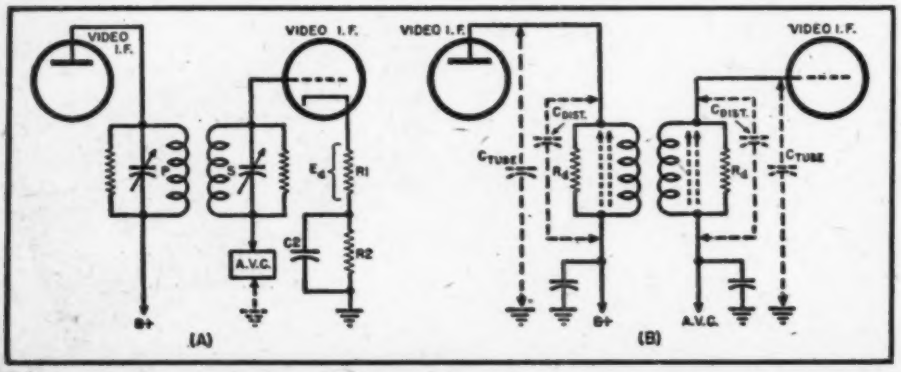
To satisfy the widest demand, an FM broadcast receiver designed for home use should also provide for reception of AM broadcast stations over the 535-1605 kc. AM broadcast band, and those on one or more of the AM short-wave bands. The i.f. value and response characteristics desirable for receivers designed for reception of the AM broadcast stations were discussed in detail in the previous article of this series. It will be remembered that an i.f. value of the order of 455 kc. is now the RMA standard, and a passband characteristic approximately 10 kc. wide is required for this service. These values are also satisfactory for the reception of short-wave AM broadcast signals. For FM broadcast reception an i.f. of 10.7 mc. is now the RMA standard, and a 150 kc. passband is required. How are both characteristics to be made available, at will, in one receiver?

The problem has been attacked in three different ways[2]. In one, independent i.f. amplifiers, each designed to provide the special characteristics required, are used for AM and FM reception and are automatically switched into the circuit by the AM/FM waveband switch. In another, either of two different sets of i.f. transformers, one for AM reception and one for FM reception, can be switched into the i.f. amplifier circuit to act as the coupling units between the single set of i.f. amplifier tubes. Of course, the switching circuits necessary in this system are objectionable.

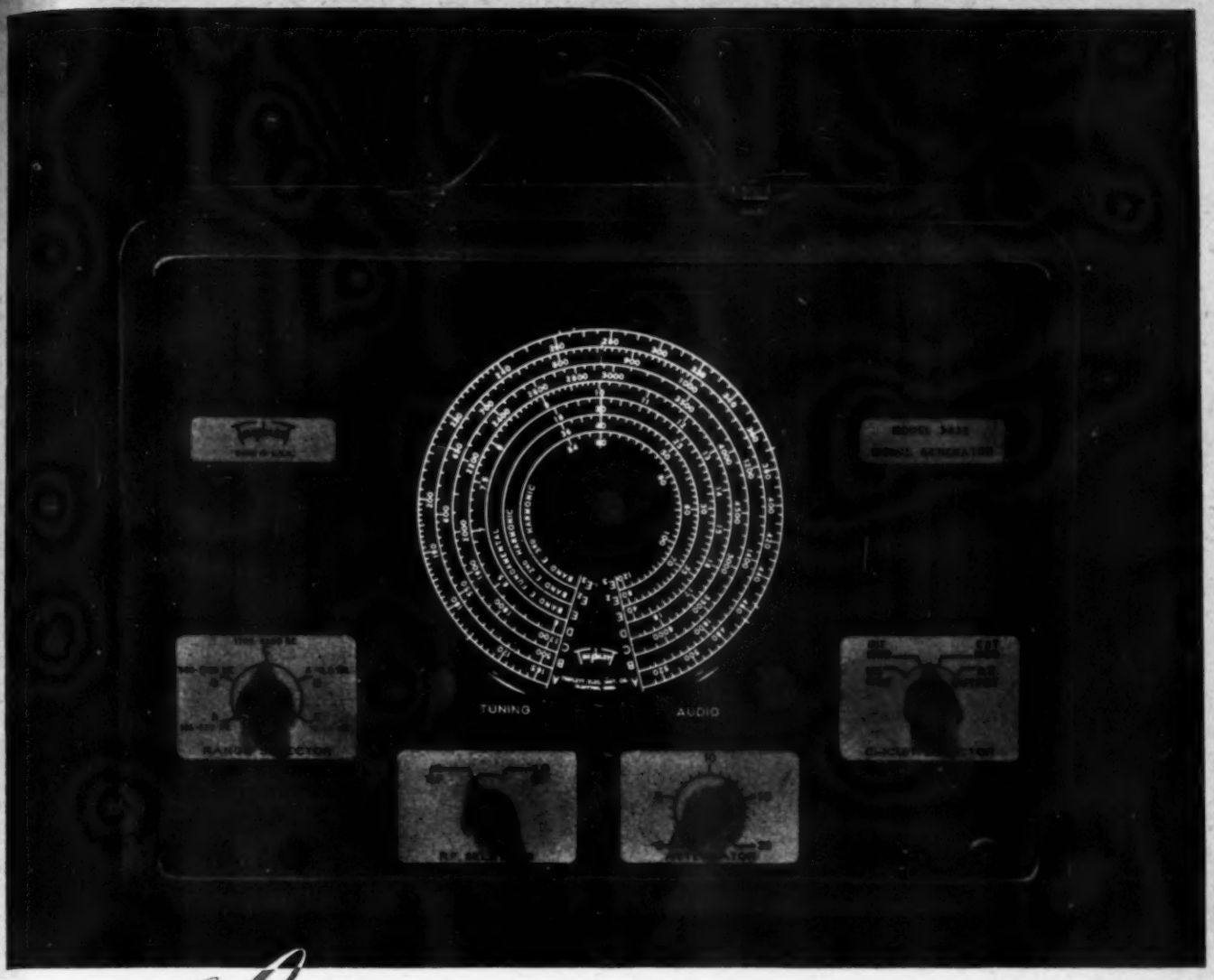
In the third (and now most popular system for combination AM/FM broadcast receivers and AM/FM communications receivers), "combination" type i.f. transformers, each having two primaries and two secondaries, as shown in Fig. 6A, are employed. Tuned primary and secondary windings L_1 and L_2 constitute the FM i.f. coupling transformer designed to operate at the intermediate frequency chosen for FM reception (a 10.7 mc. i.f. is now the RMA recommended value for FM receivers, but other values, such as 4.3 mc. and 8.6 mc. have been used in some receivers). The trimmer condensers C_3 and C_4 used to tune the AM windings L_3 and L_4 are sufficiently large in value so that they act as very effective *bypass* condensers for the 10.7 mc. FM i.f. signal. Consequently, when FM signals are being received, L_1 and L_2 and their tuning condensers C_1 and C_2 constitute the FM transformer operating at 10.7 mc., and the circuit effectively is essentially that shown in Fig. 6B. Observe that windings L_3 and L_4 become effectively bypassed out of the circuit for the 10.7 mc. i.f. signal. The L_1C_1-L_2C_2 tuned circuits are designed to be sufficiently over-coupled so that the full wide-band 150 kc. bandpass characteristic desirable for high-fidelity FM reception is provided. The desired selectivity characteristics to prevent adjacent-channel FM station interference are also provided.

During broadcast band or short-wave AM signal reception the frequency of the intermediate carrier becomes 455 kc. Primary and secondary windings L_1C_1, which are tuned to the much higher frequency 10.7 mc. can be neglected insofar as transformer action and transfer of 455 kc. signal energy from primary to secondary is concerned. However, the impedance of 10.7 mc. tuned winding L_1 acts as a loading coil for AM primary L_3, and

Fig. 8. (A) Application of degeneration to flatten frequency response of video i.f. amplifier. (B) Iron-core video i.f. coupling transformer windings tuned by distributed capacitance existing in input and output circuits (shown dotted in the diagram).



[2]For a discussion of AM/FM receivers see Alfred A. Ghirardi, Practical Radio Course, Part 56, (RADIO NEWS, November, 1947).



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that of 10.7 mc. tuned winding L_4 acts as a loading coil for AM secondary L_5. Therefore, the loading effects of the FM tuning circuits are included in determining the peaking of the AM tuning circuits to resonate at 455 kc. The circuit which becomes effective for AM signal reception is essentially that shown in Fig. 6C. The design of tuned primary and secondary windings L_5 and L_6, and the coupling between them, is such that the usual 9.5 or 10 kc. bandpass steep-sided response characteristic required for reception of AM broadcast signals is provided. Observe that the changeover to the proper i.f. transformer windings is accomplished automatically, without need for complicated and costly switching circuits.

Wide-Band Video I.F. Amplifiers

The requisites[3] of the *video* (picture) i.f. amplifier of a television receiver are so much more severe than those of the sound i.f. amplifier, or the i.f. amplifier of either an AM broadcast or FM broadcast receiver, that many special and important circuit features must be employed in such amplifiers. A review of these requisites follows:

1. Briefly, the frequency-converter tube of a television receiver ordinarily changes the incoming video carrier to an intermediate frequency of between 25.75 and 26.4 mc. (postwar RMA recommended standard). The video signal bandwidth that must be handled at this extremely high carrier frequency approximates 4.5 mc. Consequently the ratio of the i.f. amplifier passband width required, to the frequency of the video i.f. carrier is approximately equal to the abnormally high value of 17.5% (contrast this with values of $10 \times 100/455 = 2.2\%$ for the similar ratio in AM broadcast receivers, $105 \times 100/10{,}700 = 1.4\%$ in FM broadcast receivers, and 0.236% in the sound i.f. amplifier of television receivers).

2. The video i.f. amplifier must also provide sharp attenuation at the low-frequency end of its passband (see bottom curve in Fig. 9) in order to eliminate the FM sound signal associated with the picture signal. In fact, this cut-off must be so sharp that such amplifiers contain special rejection filter networks[3] to aid in sharply attenuating this sound signal and also the sound signal of the next lower-frequency adjacent-channel television transmitter.

3. As vestigial sideband transmission (a modified form of single-sideband transmission wherein one sideband is largely suppressed at the transmitter) is employed (in the U.S.A.) for the video signal, the video carrier frequency is near the edge of the transmission band rather than in the middle. Also a special shape of video i.f. amplifier response characteristic is required in the region of the video i.f. carrier frequency (it

[3]See Alfred A. Ghirardi, Practical Radio Course, Part 57, (RADIO NEWS, December, 1947).

No other name means so much!

must be down 50% at the video i.f. carrier frequency) to compensate for the overemphasis of the lower-frequency video modulations that result from the particular video signal transmission characteristic employed in the vestigial sideband transmission.

In order to obtain the unusually wide 4.5 mc. over-all passband characteristic required in the video i.f. amplifier, heavily overcoupled double-tuned interstage i.f. transformers are usually employed. The heavy overcoupling produces a broad response characteristic that contains marked double peaks with deep dips between[4], as shown at (B) of Fig. 7. The flatness of the frequency response of overcoupled double-tuned coupled circuits depends mainly upon the circuit Q's; the Q may be conveniently lowered by shunting one, or both, tuned circuits by a damping resistance of suitable value as shown at (A) of Fig. 7. This has the effect of reducing the peaks, as shown at (C). Since the gain per stage is also reduced by the damping resistors (compare the response in (B) and (C), the flattened wideband response is obtained at the sacrifice of amplification. Because the gain per stage realized in such amplifiers is comparatively low, four stages of video i.f. amplification are usually used in television receivers in order to produce the required gain.

When heavy resistive loading is used to obtain wide, flat response it is possible to predict the value of damping resistor R_d required, by means of the approximate relation:

$$R_d = 1/6.28\Delta f\, C$$

where: Δf = width of the passband
C = circuit tuning capacitance shunting the winding to which the damping resistor is applied.

It is interesting to observe that the resistance of R_d is determined only by the required bandwidth and the circuit tuning capacitance. Because the gain of the amplifier is limited by this resistance, it can easily be seen why it is important to use as high a value of loading resistance as possible in order to realize maximum available gain. For a given bandwidth, the value of R_d will increase as the circuit-tuning capacitance C_t used decreases (since R_d varies inversely with C_t). If the primary and secondary tuned circuits of the i.f. transformers are to be tuned to the video i.f. by use of only a small value of tuning capacitance, the L/C ratio of these tuned circuits must be made extremely high.

In order to make it possible to use a very low value of circuit-tuning capacitance (for the above reason) the primary and secondary windings of video i.f. transformers are designed to have sufficient inductance so that each is tuned to the required high video i.f. simply by the total circuit-capacitance of the circuit in which it is connected

(*Continued on page* 110)

[4]For a discussion of the response characteristics of over-coupled i.f. transformers see Alfred A. Ghirardi, Practical Radio Course, Part 58 (RADIO NEWS, January, 1948).

12" 3 Lb. Magnet $9.95

12" 3 pound Alnico three magnet with 1¼", 8 ohm voice coil. A top quality PM speaker for public address and fine home reproduction use. You can't go wrong on this nationally known speaker value. Every speaker guaranteed brand new, factory cartoned and of latest production. A $30.00 value. Stock No. 12PE. Net **$9.95.**

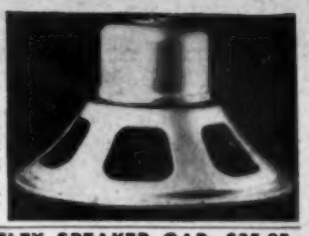
15" 7 Lb. Magnet $24.95

A $40.00 value 15" high fidelity, super heavy duty 45 watt permanent magnet speaker. This speaker is tops. Has a 1½", 8 ohm voice coil and a 7 pound Alnico 5 magnet. The 7 pound magnet in this speaker produces a force factor, that is unexcelled by any other speaker magnet. Guaranteed to be a name brand speaker. Every speaker brand new and factory cartoned. Stock No. 15PV. Net **$24.95** each. Two for **$47.50.**

15" 1000 Ohm Field $13.95

15" high fidelity dynamic speaker. Guaranteed top quality and made by a nationally known manufacturer. Latest production, brand new factory cartoned. A full 15" speaker, with 1000 ohm field and a 1½", 16 ohm voice coil. This speaker will take 30 watts, with exceptional high and low frequency reproduction. Well worth twice our price. Stock No. 15UZ. Net **$13.95**, each. Two for **$26.50.** Every speaker guaranteed.

15" CINAUDAGRAPH JUKE BOX SPEAKER $9.95



Here is without a doubt the best bargain in the whole U. S. A Jumbo 15 in. speaker made for the famous Aireon Juke box. Has standard 1⅛ in. 16 ohm voice coil and 12000 ohm field. The field may be easily excited by hooking to your radio or amplifier as a bleeder. Packed in original cartons. Fully guaranteed. Here is your chance to get a speaker that will bring out those low notes. Our scoop price, $9.95 each.

Popular P.M. Speakers

AT LESS THAN HALF PRICE
EVERY SPEAKER GUARANTEED

4 in. P.M.	1 oz.	Alnico V. mag.	$0.99
5 in. P.M.	1 oz.	Alnico V. mag.	$0.99
5 in. P.M.	1.47 oz.	Alnico V. mag.	$1.19
5 in. P.M.	2.15 oz.	Alnico V. mag.	1.49
6 in. P.M.	1.47 oz.	Alnico V. mag.	1.49
6 in. P.M.	2.15 oz.	Alnico V. mag.	1.98
6 in. P.M.	3.16 oz.	Alnico V. mag.	2.95
8 in. P.M.	2.15 oz.	Alnico V. mag.	2.95
8 in. P.M.	3.16 oz.	Alnico V. mag.	3.45
8 in. P.M.	20 oz.	Alnico 3. mag.	3.95
10 in. P.M.	20 oz.	Alnico 3. mag.	4.45
12 in. P.M.	20 oz.	Alnico 3. mag.	4.95
12 in. P.M.	7 oz.	Alnico V. mag.	5.95
12 in. P.M.	46 oz.	Alnico 3. mag.	9.95

SAVE ON FIELD SPEAKERS

4 in.	Dynamic.	450 ohm field. $1.89
5 in.	Dynamic.	450 ohm field. 1.89
5 in.	Dynamic.	3000 ohm field. 1.89
6 in.	Dynamic.	450 ohm field. 1.96
8 in.	2 ohm field for heavy duty auto radio use.	2.95
8 in.	Dynamic.	1000 ohm field. 2.95
12 in.	Dynamic.	1000 ohm field. 4.95
12 in.	RCA 450 ~ Reg. 10.00 net 1¼" Voice Coil. Scoop Price.	4.95

SPEAKERS WITH OUTPUT ATTACHED

5 in. P.M. 1.47 oz. Alnico V. mag. with 50L6 output. Special **$1.49**

5 in. P.M. 1.47 oz. Alnico V. mag. with Push-Pull output trans. Scoop **$1.69**

5⅛ in. G.E. P.M. Square with 50L6 output trans. mounts in place of regular 6 in. speaker. **$1.95**

6 in. P.M. 1.47 Alnico V. magnet with 7000 ohm primary output trans. Special **$2.25**

POPULAR OVAL SPEAKERS

4x6 in.	P.M. 1.47 oz. Alnico V. mag.	$1.49
4x7 in.	P.M. 2.15 oz. Alnico V. mag.	1.95
4x6	Dynamic. 450 ohm field.	1.95

100 Assorted trimmer and padder condensers. All are small receiver type. Some are .0-50, 0-100 and 0-300 mmfd. All are new and very clean. Packaged by Solar. A scoop value for only **$3.95.**

2 Band coil, condenser kit. Consists of a matched 2 gang condenser, band switch and antenna and oscillator coil; for broadcast and foreign short wave. Scoop price **$1.95.**

Crystal hand mike, with 12 feet of cable. A handy item to have around. Scoop price; while they last, **$3.95.** each.

"HOTTEST PICK ME UP RADIO IN AMERICA"

NO TALLER THAN A PEN

NET EACH $22.95

IN LOTS OF 3 $21.95

Model 747—3 way personal radio. Receives broadcast 550 to 1650 KC. Small size only 4x5x8 inches. However, uses full size parts with 2-gang condenser and loop. Priced complete with 4 miniature tubes and disc rectifier. These sets are only slightly larger than the smallest personal radio. Volume and tone like a big set. Kit of batteries $2.05 extra.

MECK PEE WEE SUPER $11.95

Meck, 5 tube superbet; using miniature tubes. Small plastic cabinet (7x4x5"). 2 gang condenser, loop antenna. Alnico 5 PM speaker. This is a red hot value in a small radio receiver; broadcast 550 to 1650 KC. Priced with tubes; ready to play.

Model 800B, Black plastic cabinet. $11.95
Lots of 3. $10.95
Model 800W, White plastic cabinet. $12.95
Lots of 3. $11.95

Weight 5 lbs.

$50.00 VALUE DAYCO TUBETESTER $32.50

Latest up to date Dayco portable tester, with illuminated roll chart; with wide angle magnifying lens. Never becomes obsolete. Sockets are provided for all bases: 4, 5, 6, 7, prong, octal, loctal, acorn, bantam, miniature, etc. Has both quality and short tests. Best tube checker value today. Portable Model 2194 Net **$32.50.** Model 2193 is the same as the 2194 except it is a counter model in black wrinkle finish, with sloping front panel. Counter Model 2193 Net **$29.50.** These tube checkers should sell for at least $10.00 more.

CARTONED RADIO TUBES

"OUR OWN PRIVATE BRAND"

HYVAC . . . 39c EACH

100 ASSORTED FOR $35.00

These tubes are boxed and branded HY VAC. All are guaranteed best quality. Full Replacement.

12SA7GT	6K7GT	6SA7GT	6SJ7	1R5
12SK7GT	6A8GT	1B4	12AT6	1S5
12SQ7GT	5Y3GT	39	12BA6	#3Q4
35L6GT	12A6	6SD7GT	12BE6	3S4
35Z5GT	12SR7	6SK7GT	35W4	70L7GT
12K8	6Q7GT	6SQ7GT	50B5	32L7GT
12SF7	6K6GT	25L6GT	35B5	
50L6GT	6V6GT	117Z3	1T4	
6SN7GT	6X5GT	117L7GT	1L4	

75% OF ALL THE TUBES YOU USE FOR 49c each

Guaranteed	Standard Brands	Cartoned and	Uncartoned.
5U4G	6SF5	12SG7	14R7	43 78
6C5	6SF7	12SH7	14S7	45 80
6C6	6SG7	12SJ7	25Z6GT	56
6D6	6SH7	25L7GT	26	76
6F6GT	6SL7GT	14A7/12B7	27	75
6H6	6SR7	14B6	35Z3	77
6J5	12C8	14C7	35Z4GT	
6K6GT	12H6	14H7	41	49c EACH
6SC7	12J5GT	14Q7	42	

7A6	7H7	35A5	ILA4	ILE3
7A7	7N7	0Z4	ILA6	ILH4
7A8	7Q7	1H5GT	ILB4	ILN5
7B4	7Y4	6A7	ILC5	79c EACH
7B5	7Z4	6A8	ILC6	
7B6	30	1N5GT	ILD5	
7B7	32	1A7GT	0Z4	
7C6	33	30SGT		
7C5	34	50A5	1N5	
7E7	35A5	35Y4	1A7	59c EACH
7F7	35/51	69c EACH	1H5	
	10Y		1A5	

SCOOP! ON NEW C.R. TUBES

Brand New Fully Guaranteed

3 API	$1.95	5 FP7	$1.95
3 BPI	1.95	7 FP7	2.95
5 CPI	1.95	9 LD7	2.95
5 BP4—Has white screen; ideal for television.			$2.95

4 MFD oil filled screw mounting 1½x4 aluminum can paper condenser. Replaces 8 mfd electrolytics and won't blow at 1000 volts. Ideal for amplifiers and radio set replacement. **49c** each. Ten for.... **$4.50**

We guarantee every condenser to be of fresh stock. Made by nationally known manufacturers. No Junk.

Guaranteed all good brands condensers; .001, .005, .01, .02, .05, all 600 volt. Any size $0.60 each, 100 assorted for. $6.50

POPULAR F.P. ELECTROLYTICS

In Alum. Cans. Easy Twist. Mounting all small size. All are 1x2 or 1x3 in.

40x20 150V. .39c	16x16x450V. .49c
40x20 150V. 10x25V. .49c	20x450V. .39c
40x20x10 150V. .69c	20x350V. 20x20 25V. .19c

TUBULAR ELECTROLYTICS

In paper tubes with pig tail leads

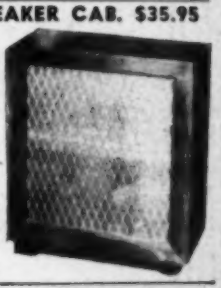
8 Mfd. 450 Volt Tubular.	.39c each;	100 for $32.50
16 Mfd. 450 Volt Tubular.	.59c each;	10 for $ 5.25
8x 8 Mfd. 450 Volt Tubular.	.49c each;	10 for $ 4.50
20x20 Mfd. 150 Volt Tubular.	.39c each;	10 for $ 3.50
50x30 Mfd. 150 Volt Tubular.	.49c each;	10 for $ 4.25
50x30 Mfd. 150 V. 20 Mfd. 25 V.	.59c each;	10 for $ 4.90

14-WATT AMP. $29.95

THIS AMP. SHOULD SELL FOR $50.00

Here is a high fidelity amplifier scoop we may never be able to offer again. Licensed under Western Electric patents. Brand new factory cartoned, 14 watt average output; 25 watt peak output. Matches 4-8-16 or 500 ohm line. Complete with tubes 6SL7, 6SN7, 2—12SL7, 2—6V6gt and 5Y3. Designed for 110 volt AC, 60 cycle operation. Frequency response 50 to 12,000 CPS. Hum level down 69 DB. Gain for two mikes and one phono pick-up. Eastern amplifier. Model E14A. Net **$29.95** Model E25A. Same as model E14A, except it has 2—6L6 output tubes, giving 30 watts output. NET **$44.95**

BASS REFLEX SPEAKER CAB. $35.95



Bass reflex speaker cabinet for either 12" or 15" speakers. Beautiful all walnut construction. Dimensions, 30" high, 15" deep and 28" long. Attractive front grill, made of expanded metal. Internal construction is of the accepted bass reflex design. This cabinet is very attractive and will match living room furniture. Stock No. WL-158. Weight 40 lbs. ..Net ... **$35.95**

Latest Alnico 5 P.M. Cinaudagraph 12", wide range speaker. (Has built-in high frequency tweeter and matching network) 8 ohm voice coil.

Dealers Net **$16.17**

RECORD ALBUM CABINET $36.95

All walnut record album cabinet. Double hinged doors; for easy access to record albums. Holds both 10" and 12" albums. Hand rubbed finish. Dimensions, 24½" high, 22" wide and 16" deep. This is a beautiful cabinet; made to match living room furniture. Weight 35 lbs. Stock No. WLR-102. Net **$36.95.**

PORTABLE RECORD PLAYER KITS

KIT MODEL J-41. Our leader record player kit. Fine tone, low needle scratch; includes two-tone leatherette covered portable case, rim-drive photo motor, high output crystal pick-up and 5" Alnico 5 PM speaker. 70L7 ready wired and tested amplifier. No wiring to do, just mount the parts in the case. Has the tone and volume controls.

Kit Model J-41...Net **$14.95**

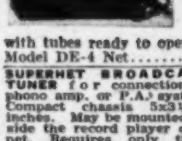
Kit model 61-X. Has a beautifully made leatherette covered portable case; similar in appearance to our model J-41. Has an even speed 78 RPM phono motor, light weight crystal pick-up and a powerful 4 tube transformer type; wired and tested, push-pull 7C5 phono amplifier. Has separate tone and volume controls. Full 6½", heavy duty PM speaker. All you do, is mount the amplifier, motor and pick-up. This is the last word in portable record players. Kit 61-X. Net **$22.95.** Above kit model 61-X, with single post automatic record changer **$29.95.**

POWERFUL SINGLE RECORD PLAYER KIT Z-26. Housed in an attractive leatherette covered cabinet. Latest 78 RPM rim drive motor and light weight pick-up. Ready wired and tested 70L7 type tube amplifier. Tone and volume control, 5" PM speaker (Alnico V). This kit easily slips together. Priced complete with tubes and hook-up instructions. Kit Z-26.....Net **$9.95**

1948 MODEL—MIKE-BROADCASTER ONLY $7.95

Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2-35L6, 12SJ7 and 35Z5 tubes. Priced with tubes and connecting instructions. Wired and tested. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

3-TUBE PHONO OSC. ONLY $4.95



Model DE-4—Phonograph oscillator. Broadcasts from 800 to 1500 KC. Gain for any crystal pick up. A new powerful circuit is used to assure plenty of power. Has variable gain control for proper modulation. Priced with tubes ready to operate, two 50B5 and 34W4.

Model DE-4 Net. **$4.95**

SUPERHET BROADCAST TUNER for connection to phono amp. or P.A. system. Compact chassis 5x3½x3 inches. May be mounted inside the record player cabinet. Requires only three connections to amplifier. Uses 6SA7 or 12SA7; 6SK7 or 12SK7 and crystal diode. Complete with tubes, loop antenna, dial and instructions for connecting to any amplifier. Net **$7.95.** Specify if tuner is to be used with AC or AC-DC type amplifier.

McGEE RADIO COMPANY

WRITE FOR CATALOG
Prices F.O.B. K.C.

SEND 25% DEPOSIT—BALANCE C. O. D.
1225 McGEE ST., KANSAS CITY, MISSOURI

THE McGEE RADIO CO. PRESENTS THE GREATEST RADIO KIT OF ALL TIMES

PERSONAL PORTABLE RADIO KIT MAKES A $32.50 RADIO $14.95

Complete with Batteries

Size: 6½" x 3¼" x 4⅛" Weighs Only 3½ Lbs.

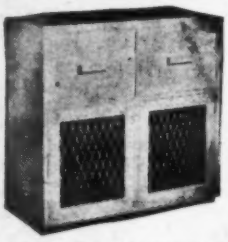
- Two-Tone Ivory, Red Plastic Cab.
- Loop Aerial, Built-in Lid
- 4-Tube Superhet
- AVC.
- Looks like and is a Commercial Radio Kit
- Two-Gang Cond., Lucite Dial
- Simple Assembly and Wiring Instructions

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line-producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do, is mount the parts and wire. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the completed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band, 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 185 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy. **Model X-45. Price $14.95.** Shipping weight 6 lbs.

SCOOP MODEL X-45 PERSONAL PORTABLE KIT WIRED AND TESTED WITH BATTERIES, NET $19.95

BUILD THIS 8-TUBE RADIO-AMPLIFIER • COMPLETE KIT—ONLY $29.95

DELUXE CONSOLE CABINET $49.95



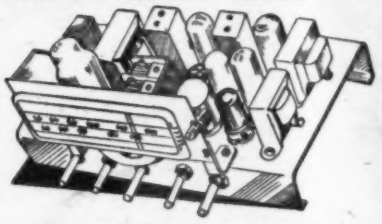
- SLIDE AWAY CHANGER COMP.
- RECORD ALBUM COMPARTMENT
- BEAUTIFUL, ALL WALNUT CONSTRUCTION

This is the first time we have been able to offer a beautiful floor model console, RADIO-PHONO cabinet. Finest all walnut construction; hand rubbed finish, 34" long, 33" high, 16" deep. Holds 12" speaker, large record compartment. Slide away changer compartment will accommodate changer of the Webster 56 class and smaller. Receiver compartment is 15x14⅛x7½ inches. Will accommodate our Model PRK-10 kit; advertised here. Dealers, here is your chance to buy good cabinets at the right price. Convert those low-priced sets into radio-phono combinations. Weight 50 lbs. Net, **$49.95.**

Price with Two Post Oak Changer.....**$66.95**

IF DESIRED, WE CAN FURNISH THIS IN BLOND MAHOGANY AT $49.95

RECEIVES BROADCAST AND FOREIGN SHORT WAVE



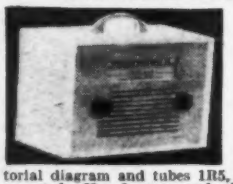
- A COMBINED BROADCAST SUPERHET RADIO CHASSIS AND 15 WATT P. A. SYSTEM
- HEAVY DUTY 12" P.M. SPEAKER
- CROW 8" SLIDE RULE DIAL. 2 GANG COND.
- REC. BROAD, 550 TO 1700 KC AND 19 TO 49 METERS
- PUSH PULL 6V6—TWIN TONE CONTROLS
- INPUTS FOR CRYSTAL OR DYN. MIKES AND PHONO-PICKUP. WE FURNISH EVERYTHING TO BUILD THIS DELUXE CHASSIS
- WHY NOT ORDER THE CONSOLE ON THE LEFT, WITH YOUR PRK-10
- CHASSIS SIZE 9½ x 11 x 8" HIGH

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs.

PRK-10 Radio-Amp. Kit with 12" P.M. speaker. With tubes .....Net **$29.95**

CPR-15. Exactly the same kit as the PRK-10 kit; except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit.....Net **$37.95**

SMALL PORTABLE KIT, $10.95

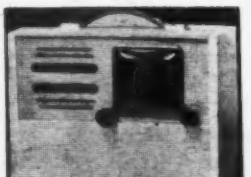


- 4-Tube Broadcast Superhet
- Priced Complete with Batteries
- Dynamic Speaker • Slide Rule Dial

PORTABLE KIT MODEL K-PX. Small size leatherette covered case 9x5½x5. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with avc. Has 3 inch Alnico five PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1S5, 1T4 and 3S4. Not AC DC, but straight battery operated. Has 2 gang cond. Everyone should have one of these personal portables. Everything furnished. Kit K-PX.....Net **$10.95**

3-WAY PORTABLE KIT, $16.95

- 4 Tubes Plus Disc Rectifier
- 300 Hour Battery Pack Included
- Beautifully Built Portable Case



Build this powerful, 4-tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All Parts and batteries are furnished including tubes, Disc Rectifier, 1R5, 1T4, 1S5 and 3S4. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit Model 3-ZA. Net **$16.95**

5-Tube AC-DC Broadcast Kit, $9.95

BEAUTIFUL 10" PLASTIC CABINET
LOOP AERIAL • VERNIER DIAL
DYNAMIC SPEAKER • EASY TO BUILD

Kit Model P-85. We have finally been able to achieve our goal. Here it is. A good 5-tube broadcast AC DC superhet radio receiver for less than ten dollars. The beautiful 10 inch plastic cabinet is made of the finest material. The chassis is of the standard accepted superhet design. 456 KC ifs AVC and 5 inch Alnico 5 PM speaker. Attractive vernier dial. Two gang tuning condenser. Loop ant. We defy anyone to offer a better working AC DC receiver kit. Priced complete with diagram, photos and tubes 12BE6, 12BA6, 12AT6, 50B5 and 35W4. Nothing else to buy. You can't go wrong on this value. Kit Model P-85.....Net **$9.95**

12-WATT AMPLIFIER KIT, $10.95

PUSH PULL 6V6 OUTPUT TUBES
GAIN FOR MIKE AND PICK-UP
EVERYTHING FURNISHED. EASY TO WIRE
FINE TONE QUALITY

KIT MODEL AC-12. 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched component parts, ready punched chassis pan. One control fades from phono to microphone. Gain enough for crystal or dynamic microphone, 100 mil power transformer, for 110 volt AC 60 cycle operation. Priced complete with tubes: 2—6V6, 6SN7, 6SH7 and rectifier. Diagrams and photos furnished. Kit AC-12. Net **$10.95.** 12" Alnico 5 PM speaker **$6.95** extra; crystal microphone and desk stand **$4.95** extra.

WIRE RECORDER $89.50

This wire recorder incorporates all necessary circuits for recording and playback. Has built-in eraser circuit. The amplifier is of the AC transformer type, with push-pull 6V6 output tubes. Has tone control and fader control. Input stage for wire recording from either crystal mike, radio receiver or phono pick-up. Amplifier is wired, tested and ready to operate. This unit is classified as a kit, only because you have to mount the Webster wire recording mechanism, amplifier and speaker. Everything is furnished, including a 15 minute spool of recording wire.

Kit includes wired and tested 12 watt amplifier, expressly made for wire recording and public address use. Leatherette split type case and 10" PM speaker, furnished with regular $52.92 Webster wire recording mechanism. Kit model GN-12. Net **$89.50.** Crystal mike and desk stand **$4.95** extra.

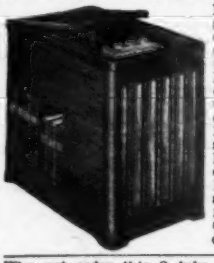
5-TUBE AC KIT, $14.95

Model JD5 AC. Has beautiful 12" walnut cabinet. All parts furnished to build a broadcast 5 tube AC, transformer type, superhet. Rec. 5.50 to 1700 KC. Slide rule dial, 2 gang tuning cond. Loop aerial. Heavy duty Alnico V. PM speaker. Everything furnished including photos, diagram and tubes. 6SA7, 6SD7, 6SQ7, 6K6 and rectifier.
Kit JD5 AC.....Net $14.95

20-WATT UTILITY AMP. KIT, $17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—6SN7, 6J5, 2—6L6GA, 5Z3. Kit Model 20-LX .....Net **$17.95**
12" 12 watt Alnico 5 PM speaker, $5.95 extra. Crystal mike and desk stand, $7.95 extra.

ARMCHAIR RADIO CABINET, $29.95



Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep, and 27" wide. Ample room for radio receiver 14" long, 9" high and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet Ar-15 Net **$29.95.** Detroit automatic changer **$12.95** extra. Twin post Oak changer **$17.95** extra.

Why not order this 9 tube radio chassis kit with the armchair cabinet? Build a high fidelity broadcast receiver, 12" PM speaker. Kit has 10" slide rule dial, conventional two gang superhet circuit. Complete with tubes: 12K8, 12SK7, 12H6, 12J5, 12SL7, and 4—12A6, in push-pull parallel. A deluxe type kit. Diagrams and photos furnished. Chassis Kit AHK-2.....Net **$19.95**

McGEE RADIO COMPANY

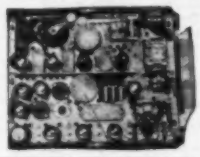
WRITE FOR CATALOG
PRICES F. O. B. K. C.

SEND 25% DEPOSIT — BALANCE C. O. D.
1225 McGEE ST., KANSAS CITY, MISSOURI

Army BC-645 I.F.F. TRANSMITTER RECEIVER $9.95

Brand New 450 M.C.

2 big units; all in one. A 10 tube superhet receiver for 450 Megacycle, a 5 tube 450 megacycle tuned line transmitter. Both are two channel. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955, 1-WE 316A. The tubes that come with this unit are worth more than our sale price. This unit originally designed for identification "Friend or Foe" Army BC-645. Brand new factory cartoned, weight 25 lbs. Furnished with four page conversion instructions for a CW or MCW or phone transmitter. How to build a 110 volt AC power supply, etc. 12 volt dynamotor, $2.95 extra. WE-316A tube $.99, BC-645 . **$9.95.** 2 for **$19.00.**

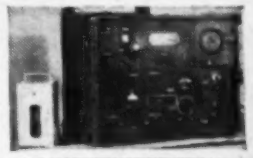


Army BC-654 80 METER XMITTER RECEIVER $12.95

BC-654—Two for $25.00

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3—1N5GT, 1—1A7GT, 2—3Q5GT, 1—H5GT tubes, 6 tube transmitter, with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2—807A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hams! Comes complete with cover; furnished with all tubes necessary for the operation of the trans. and rec. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. . . . **$12.95**; 2 for **$25.00.** 654 Vibrator Pack 6 for 12 V.D.C. input **$4.95** extra.

SCOOP. BC-654 Less all tubes. Net **$7.95**



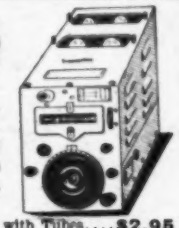
ARC-4 $14.95

IDEAL FOR 2 METERS

Priced Complete With 20 Tubes—and 12-28 Volt Dynamotor

FOUR CHANNELS CRYSTAL CONTROLLED. ARC-4 for VHF frequencies 140 to 144 megacycles. There are 7 tubes in the transmitter: 832, two 1614, two 6V6 and two 6L6. The receiver section has 13 tubes: two 6AC7, four 6N7, three 12SJ7, two 12SQ7 and two 12A6. The unit is actually two receivers and one transmitter in one piece. One receiver is for stand-by use. Has built on dynamotor for 12 or 24 volt DC operation. Priced complete with tubes and four crystals and dynamotor. Hams convert this for two meter operation. It's a scoop at this price. Used, but guaranteed to be in good condition.

NEW COMMAND XMITTERS $5.95



With each command transmitter, we furnish a schematic of the BC-458 (All command Transmitters are essentially the same; except for frequency.)

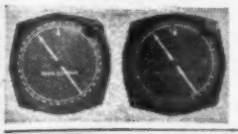
Near New BC-457, 4 to 5.3 MC with Tubes....	**$2.95**
Brand New BC-457, 4 to 5.3 MC with Tubes.	5.95
Near New BC-458, 5 to 7 MC with Tubes....	2.95
Brand New BC-458, 5 to 7 MC with Tubes...	5.95
Twin Rack for 2 Transmitters.....	.99
Antenna Current Meter.....	1.95
Near New BC-456 Modulator, with 28 v dynamotor	2.95

COMMAND REC. WITH DIAGRAMS

Order your Aircraft command receivers from McGee. We furnish you a schematic of the BC-454 (all are the same except for frequency). Also, a diagram showing how to convert receivers for 110 volt operation.

Brand New BC-453, 200 to 500 KC with Tubes	**$7.95**
Near New BC-453, 200 to 500 KC with Tubes	4.95
Brand New BC-454, 3 to 6 MC with Tubes..	4.95
Near New BC-454, 3 to 6 MC with Tubes..	2.95
Near New BC-455, 6 to 9 MC with Tubes..	3.95
Brand New BC-946, Broadcast 550 to 1500 KC, with Tubes and Instructions.....	12.95
Triple Remot Control Head for 3 receivers...	1.95
Triple Mounting Rack for 3 receivers.....	.99
28 volt Rec. Dynamotor.....	.99

SELSYN INDICATORS $2.95



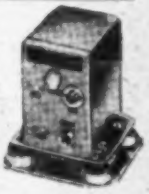
Selsyn indicators. 5" diameter. Will operate on from 15 to 24 volts 60 cycle AC. Model I-82A can be used as either selsyn transmitter or selsyn receiver. Scoop Price, $2.95, 2 for **$5.49**

SCR-518 ALTIMETER $29.50

Brand New

Famous SCR 518 A Altimeter. Brand new factory cartoned. Worth over $900.00. Made by RCA. Complete as pictured. Has 20 tubes. Works in the 500 MC region. This is the complete unit. Transmitter, receiver, power supply and 5" scope indicator. Reads altitude up to 30,000 ft. Operates on 28 volts. D.C. Complete with tubes, 6SK7, 2 8012, 2 6SJ7, 6C8, 6SN7, 6F8, 23D4, 6Y6, 6V6, 10 6AC7 3 2X2, 954, 955, 956, 6J5 and 3 in. CR tube 1808P. A RED hot scoop at only **$29.95** complete.

MARKER BEACON REC. $2.95



BC 1023 A Marker beacon receiver. Designed for reception of modulated signals of the 75 MC band. Variable tuning permits coverage of 62 to 80 MC. Brand new factory cartoned. With tubes 6SQ7, 6U6, 6SC7 and 12SH7. Operates directly from 12 or 14 volts DC. Priced for quick sale only **$2.95.**

3" SELSYN INDICATOR

Works on 16 to 25v. 60 cycle

$2.45 EACH Two for **$4.45**

CARBON HAND MIKE, 99c

Army carbon hand mike with push-to-talk switch, cord and plug. Brand new and factory cartoned. While they last. **99c** each; two for **$1.89**; ten for **$6.90.**

ARMY $6.95

Field Telephones

EE-8 Army field telephone. These units are used, but in good condition. Priced complete with telephone hand set, hand powered magneto and canvas carrying bag; as pictured. Net **$6.95**, each.

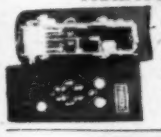
SCOOP! 110 M.C. REC. $6.95

BC-733 D Localizer Receiver

Freq. 108-110 Mc; Tube complement; 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—AH7GT, 2—12SG7, 3—717A. Now only... **$6.95**

NEAR NEW CONDITION. A RED HOT VALUE.

VIBRATOR SCOOP $1.99



Heavy Duty Vibrator—Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price..... **$1.99**

135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor. **$5.95**

(Use with above vibrator.)

MODULATOR SALVAGE $2.49

Another red hot value in salvage. All kinds of good usable parts in this unit. Con. Res. Relays, Modulation trans. and tubes VR150, 1235 and 1625. Brand new and in factory carton. Originally designed to modulate the BC-457 W.E. Transmitter. You can find many uses for this BC-456 Modulator scoop. Price **$2.49; 2 for**..... **$4.49**

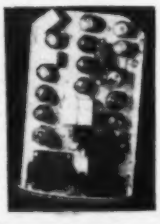
VEEDER ROOT METER

Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jewelled dialite, pilot light enclosed, 3 position switch, counts up to 1000.

Each **95c**

15 TUBE SCOOP $9.95

BRAND NEW



AM 61A Indicator Amplifier. Brand new factory cartoned. Has 28 volt DC Blower motor and fan. 2 2mfd 1000 volt cond. 2 2X .5 mfd. 1000 volt cond. and many other parts. Complete with 15 tubes, 7 6SN7, 3 VR 105, 5Y3, 3 6SL7, 8016. As a salvage item this is a RED Hot Buy. The tubes are worth more than our price. Weight 30 lbs.

Net **$9.95**

PULSE FORMING NETWORKS

Used in small radar modulators, available in three sizes, 67 ohms impedance. 7.5 Kilowatt rating.

H-603, one micro second, 200 pulses per second	**$1.95**
H-601, three micro seconds, 200 pulses per second	2.95
H-602, 10 micro seconds, 60 pulses per second.	3.95
All three of above, for only.....	6.95

MAGUIRE AUTOMATIC RECORD CHANGER $9.95

Brand new factory cartoned. This changer should sell for three times our price. Latest two-post, quick change type. Has permanent built-in needle, shuts off on the last record. Plays 12 10" or 10 12" records. Fully guaranteed. Base size 16 x 13 inches. Scoop price $9.95. Made to fit walnut base $2.49, extra.

Aere Changer, Base size 12 x 13 inches **$12.95.** Walnut base $2.49 extra.

Vm-800 Changer, Base size 13 x 14 inches **$14.95.**. Walnut base $2.49 extra.

Oak Twin-post Changer, Base size 14 x 14 inches **$17.95.** Walnut base $2.49 extra.

General Instrument Deluxe Changer, Base size 11 x 12 inches, **$17.95.** Walnut base $2.49.

Aviola Changer, Base size 11½ x 12 inches, **$14.95.**. Walnut base $2.49 extra.

AM-26 $1.49

AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9½x4½x5". Has two transformers, four tube sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.

$1.49; 2 for $2.49

SCR 269G A.D.F. $39.50

SCR-269G Automatic Radio Direction Finder has 17 tubes. Frequency coverage from 200 to 1750 KC, inclusive. Receivers are in perfect condition. All of the component parts are new. Consists of receiver, new RDF loop, remote control, relay, dehydrator, cables, plugs, etc. This is a terrific value at only **$39.50.** Only 50 are available.

RDF RECEIVER

$19.95

MM-26-C Compass Receiver. Brand new factory cartoned. This unit covers from 150 to 1500 KC inclusive; in three bands. Complete with eleven tubes of the 6 volt type; 6SA7, 6SK7, 6F6, etc. Has 28 volt built-in dynamotor. There is no dial built on unit and no remote cables are provided. MM-26-C receiver $19.95. Remote control $3.95 extra.

Manually operated loop..... **$6.95** extra

PE 206A INVERTER—BRAND NEW $4.95

P.E.-206A Invertor. Brand new factory cartoned. For 25 to 28.5 volts input. Output of 40 volts (plus or minus 3 volts) at 800 cycles, at 500 volt-amperes. This is a perfect invertor. Has carbon pile regulator, built-in voltage control. A 20 stack selenium rectifier. Shipping weight 45 lbs. PE-206A Net..... **$4.95**

PE 101C DYNAMOTOR BRAND NEW $2.95

Dynamotor PE-101C. Input voltage 13 or 26 volts DC, at 12.6 or 6.3 amps. Output voltage 400 volts DC at 135 Mils and 800 volts at 20 Mils, 9 volts AC at 1.2 amps. Brand new factory cartoned. Shipping weight 13 lbs. PE-101C Net..... **$2.95**

Filament Transformer. War surplus. For 60 cycle, 110 volt AC use. Has 2.5 volts at 10 amps, 6.3 volts at 5.5 amps and 6.3 volts at 1 amp. Brand new. No. D161912. While they last, only..... **$2.95**

A few BC-310 B Receivers with tubes in good condition **$24.95**

Made by World's Largest Manufacturer of Vib.

Heavy duty 4 prong vibrator, 6 volt non-syn. Has 8 points. Standard base connections fits 70% of all car radios. **$1.29** each, 10 for $11.95, 50 for $55.00, 100 for $99.95.

McGEE RADIO COMPANY

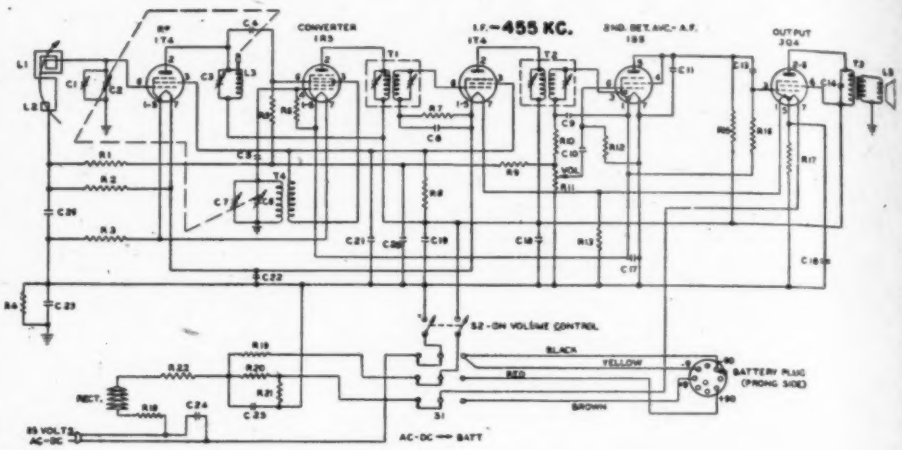
WRITE FOR CATALOG Prices F.O.B. K.C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

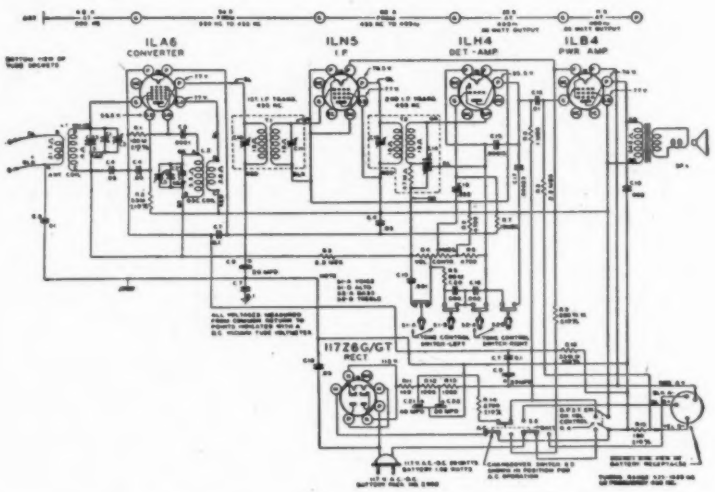
the RN CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 90)

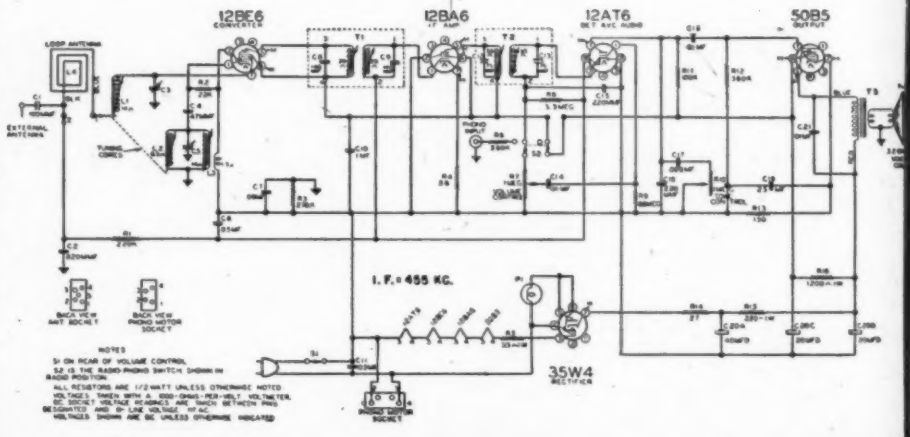
RADIO NEWS, MARCH, 1948 — **HOFFMAN MODEL A700**



RADIO NEWS, MARCH, 1948 — **ZENITH MODEL 5G036**

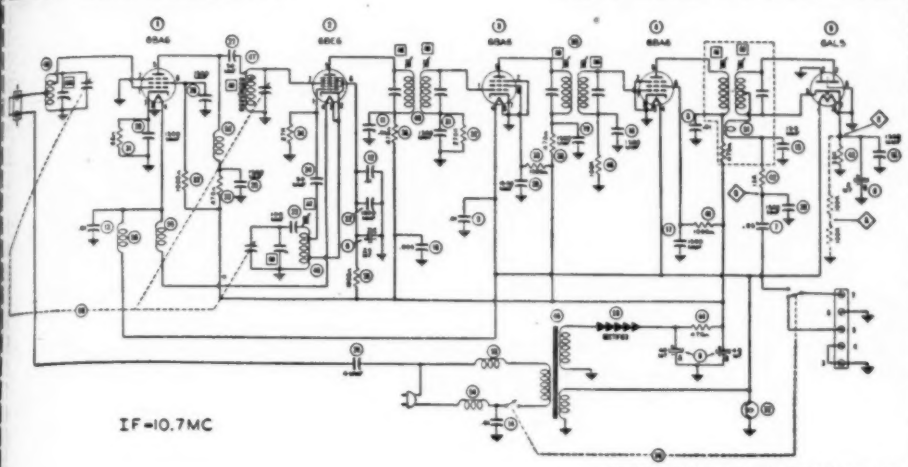


RADIO NEWS, MARCH, 1948 — **WARDS MODEL 74BR-2003**



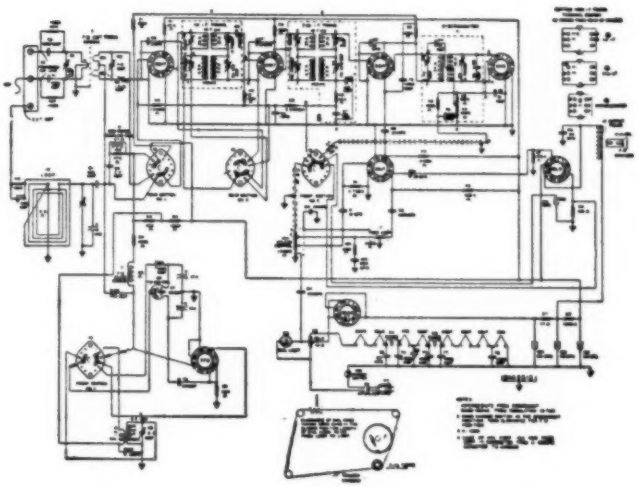
Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

RADIO NEWS, MARCH, 1948 — PILOT MODEL T-601 FM TUNER

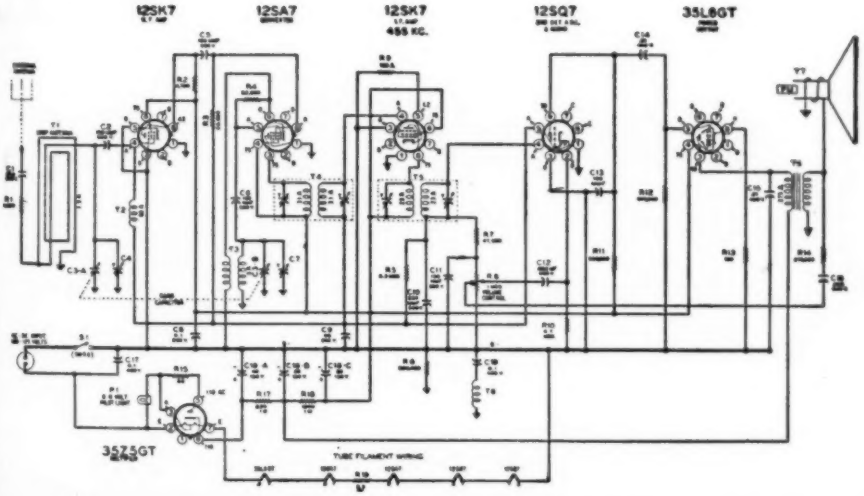


Courtesy of Howard W. Sams & Co., Inc.

RADIO NEWS, MARCH, 1948 — CROSLEY MODELS 88TA, 88TC



RADIO NEWS, MARCH, 1948 — TRUETONE MODEL D2815



BEST of SURPLUS

Best OF SERVICE FROM HEATH

POWER TRANSFORMER *Special*

A wonderful buy in a new production heavy duty power transformer. Built by a nationally known manufacturer. Primary 117V 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5 V. at 4 A. An ideal transformer for high quality amplifier modulator, small transmitter or quality radio. Will handle 13 tube radio receivers. Supply is limited, order early.

$3.95

3 FOR $9.95

Midget AMATEUR TRANSMITTER KIT

The hit of the year, using army Walkie-Talkie parts. Easily assembled into a 1 Watt 80 meter CW transmitter. Comes complete with 80 meter crystal, tube, chassis, tank coil, tuning condenser, all other small parts and complete instructions. The only other parts required are key and batteries listed below. An ideal beginner's station with range up to 500 miles. Lowest cost ever offered. Add postage for 2 lbs.

$3.95

ACCESSORIES

KEY (add postage for 2 lbs.) **$1.00**

KIT OF BATTERIES (add postage for 4 lbs.) **$3.25**

SPECIALS

PE 104A power supplies operate from 6 or 12 volt input — output 84V plate 1.4 volt filament $4.95

Ceramic Variable Condensers 50 MMF screw driver adj. Special 5 for $1.00

Lip Microphones T-45 in original sealed cartons $1.00

Thermocouples for RF Ammeters, 3 for $1.00

10 henry 50 ma Filter Chokes $1.29

5BP1 Cathode Ray Tubes $2.49

5BP1 Socket ..... .79

Syncro Motors 5SDG Brand New, ... per pair $6.95

Kit of Screw Driver Type Potentiometers ..... 10 for $1.00

Kit of Metal Tubular Bypass Condensers ..... 20 for $1.00

Kit of Relays, excellent types 5 for $2.50

Kit of Knob Type Potentiometers carbon and W.W. ..... 10 for $1.95

BC 457 TRANSMITTER

Brand new 457's identical with unit used in January 1948 CQ for conversion to mobile rig. Also tunes 80 meter band as VFO. With tubes .....

$7.95

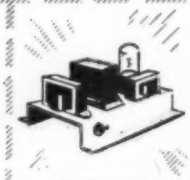
T32 TABLE MICROPHONE

One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons, add postage for 5 lbs. **$2.95**

OIL FILLED CONDENSERS

CAP	WVDC	PRICE	CAP	WVDC	PRICE
5	400	$ .39	1.	1000	$ .49
4	400	.49	2.	1000	.69
5	600	.59	4	1000	.90
8	600	1.00	.25	1500	.49
2.5-2.5-5	600	.95	1.5	1500	.79
5-5-5	600	1.95	.1	3000	1.20
8-8-8-8	600	3.95	.25	3000	1.30
.1	1000	.29	.05	7500	2.50
.25	1000	.39			

COMMAND SET ACCESSORIES



110V power supply kit with 24 volt filament, no wiring changes inside set, punched chassis and volume control $5.95

5" PM speaker with output transformer, matching headphone output $2.80

Dual receiver rack FT 277A with connecting plugs $1.00

Shock mount for above rack $1.00

Single transmitter rack FT 234A $1.00

MILITARY CONVERSION POWER TRANSFORMERS

Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V at 2A and 24V at ½A. "B" type supplies 500 VCT at 50 MA, 5V at 2A and 12V at 1 amp. State whether A or B type desired. **$2.95**

AN/APN1 RADIO ALTIMETERS

Brand new, complete with tubes, dynamotor, antennae, indicator, switch, plugs and instruction manual. Consists of 420 MC transmitter and receiver. Converts into excellent boat radar indicating in feet, or amateur 420 MC rig. In original crate .....

$34.95

DYNAMOTORS

Consists of electric motor operating generator on same shaft. Many applications — operating radios from storage battery — using as motor.

Dynamotor C — Input 28 volts, output 220 volts at 60 MA. Shipping Weight 6 pounds. **$1.50**

Dynamotor A — Input 12 volts, output 1000 volts at 350 MA. Shipping Weight 72 pounds. **$5.95**

Dynamotor B — Input 6 or 12 volts, output 500 volts, 160 MA. Shipping Weight 30 pounds. **$5.95**

HEARING AID HEADPHONES

The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete. Add postage for 1 lb.

$1.00

BATHTUB CONDENSER KIT

.1 MFD. to 1. MFD. up to 600 Volt. **20 FOR $1**

TRANSMITTER CRYSTAL KIT

4 mounted crystals between 2 MC and 3 MC. **4 FOR $1**

SOCKET KIT

20 beautiful octal, loctal and miniature sockets. **20 FOR $1**

R. F. CHOKE KIT

Perfect sizes from ½ to 2½ MH. **10 FOR $1**

POWER RHEOSTAT KIT

All knob types in 25 and 50 watt I.R.C., etc. **5 FOR $2.95**

MICA CONDENSER KIT

An excellent assortment with silver mica and regular. All color coded or marked. **25 FOR $1.00**

CERAMIC CONDENSER KIT

20 beautiful condensers all marked or coded, many zero temp. coef. types. **20 FOR $1.00**

RESISTOR KIT

The best available all insulated color coded in ½-1-2 watt sizes. **100 FOR $1.95**

TRIMMER CONDENSER KIT

10 brand new variables 12 MMF to 50 MMF ceramic insulated **$1.95**

G.E. MODEL BC-375 TUNING UNITS

These General Electric 150 Watt transmitter tuning units are the greatest surplus buy. Over $30.00 worth of new condensers, coils, switches, National Velvet vernier dial, etc. Supplied complete with cabinet and two reprints of conversion articles for transmitter and receiver reprinted from RADIO NEWS. Specify TU5B, TU10B or TU26B. Add postage for 20 lbs.

$2.49

The HEATH COMPANY

★ ★ ★ BENTON HARBOR, MICHIGAN

ONE-THIRD THE COST . . . HAVE ALL THE FUN

Build YOUR OWN TEST EQUIPMENT with HEATHKITS

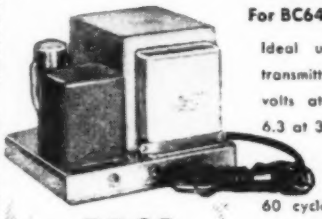
The NEW HEATHKIT VACUUM TUBE VOLTMETER KIT

Only $24.50

The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6X5 as transformer power supply rectifier. Included is means of calibrating without standards. Average assembly time less than four pleasant hours, and you have the most useful test instrument you will ever own. Ranges 0-3, 30, 100, 300, 1000 volts AC or DC. Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Complete with detailed instructions. Add postage for 8 lbs.

TRANSMITTER POWER SUPPLY KIT

For BC645, 223, 522, 274N's, etc.

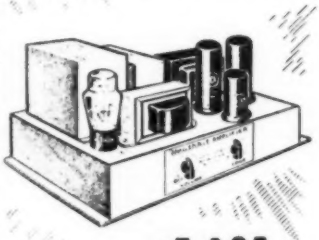


Ideal unit for powering military transmitters. Supplies 500 to 600 volts at 150 to 200 MA plate, 6.3 at 3.6A, also 9V, and 12V A.C. Kit supplied complete with husky cased Acme 110V 60 cycle power transformer, 5U4 rectifier, Sprague oil filled condenser, cased choke, punched chassis, and all other parts including detailed instructions.

$11.95

Complete — nothing else to buy.

HEATHKIT HIGH FIDELITY AMPLIFIER KIT

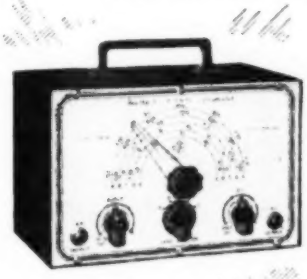


Build this high fidelity amplifier and save two-thirds of the cost. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SN7), and a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8-15 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

$14.95

12" PM speakers for above $6.95

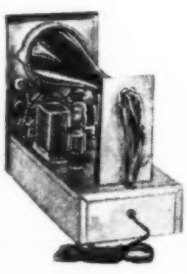
HEATHKIT SIGNAL GENERATOR KIT



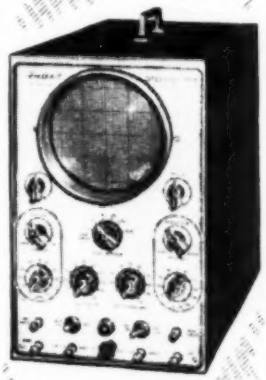
Build your own signal generator and learn while you profit. Save two-thirds the cost and have an instrument you will be proud to place on your service bench. Supplies fundamentals from 150 KC to 30 MC on large calibrated panel. 400 cy. AF modulation can be used separately for audio testing. Has transformer power supply. Furnished complete with tubes (one 6SN7, one 6X5), transformer, coils, cabinet, punched and formed chassis, blueprints and instructions, and all small parts. Add postage for 8 lbs.

$19.50

The NEW 1948 HEATHKIT 5 INCH OSCILLOSCOPE KIT



New improved model of the famous Heathkit Oscilloscope. Building an oscilloscope is the finest training for television and newer servicing technique and you save two-thirds the cost. All the features and quality of instruments selling for $100.00 or more. Supplied complete with cabinet, two color panel, 5BP1 tube, 2 5Y3 tubes, 2 6SJ7 tubes and 884 sweep generator tube. Power transformer supplies 1000V negative and 350 volt positive. Sweep generator 15 cycles to 30 M. cycles. Has vertical and horizontal amplifiers. Oil filled filter condensers for long life. Complete blueprints and instructions included.



$39.50

Nothing ELSE TO BUY . . .

HEATHKIT TRANSMITTER KIT

A best buy in an amateur transmitter kit. Circuit uses latest post war improvements, can be assembled to cover 80-40-20-10 meters with 25 Watt output. Comes complete with 80 meter crystal, modulator, 80 meter coil, four tubes, cabinet, beautiful panel and all additional parts needed less power supply. Blueprints and instructions included. Power supply kit $10.00 additional. Shipping weight 20 pounds; 8 pounds for power supply.

$19.50

NO ORDERS UNDER $2.00
We will ship C.O.D.
Add postage; we refund excess

The HEATH COMPANY

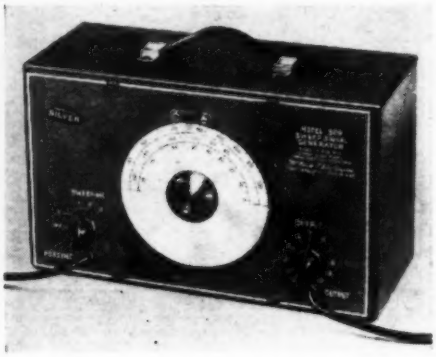
BENTON HARBOR, MICHIGAN

What's New in Radio

FM AND TV SWEEP GENERATOR

McMurdo Silver Co., Inc., is now shipping its new Model 909 FM and television sweep generator.

Designed to permit rapid and simple visual alignment of FM and TV r.f., i.f., and video amplifiers, this new



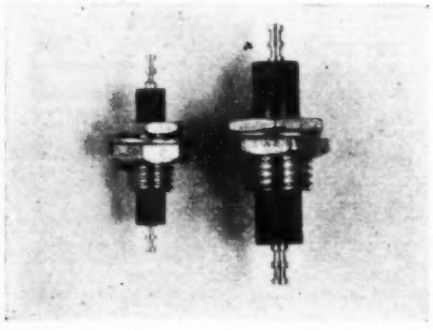
unit is especially useful to the research worker and the service technician.

The new sweep generator covers a center frequency range of 2 through 226 mc. in three bands, without usual bandswitching. Frequency modulation is adjustable from 40 kc. to over 9 mc. by a panel control, while output is adjustable by means of a second knob from 0 to ½ volt max. Synchronization of the oscilloscope used to visually trace alignment is at power line frequency (or selected multiples or sub-multiples thereof) or by sawtooth synchronizing voltage provided by the Model 909 at twice power frequency.

Price and performance data will be furnished by *McMurdo Silver Co., Inc.,* 1240 Main Street, Hartford, Conn., on request.

FEED-THROUGH TERMINALS

New, insulated feed-through terminals designed for feeding high voltages through chassis, panels, cavity walls, etc., have been placed on the



market by *Cambridge Thermionic Corporation.*

The insulating material is an approved phenolic with excellent dielectric properties. Metal parts are heavily plated and the units are constructed to withstand shock and vibration.

The terminals are available for ¼" or ⅜" hole mounting, each type in two lengths. The larger of the two ⅜" models, shown in the picture, will withstand a breakdown voltage of 8000 volts at 60 cycles, a.c.

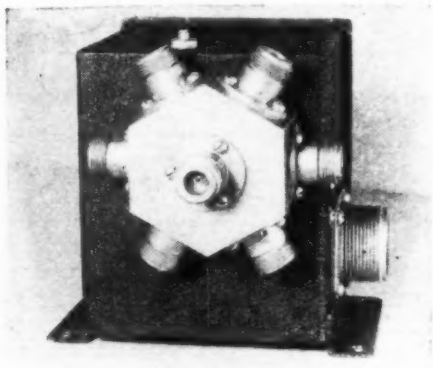
Further information may be obtained from *Cambridge Thermionic Corporation,* Department 9, 445 Concord Avenue, Cambridge 38, Mass.

COAXIAL SWITCHES

A series of unique coaxial switches, recently introduced to the trade, is in production by *Designers for Industry, Inc.,* of Cleveland.

Possessing good voltage standing wave ratio and crosstalk characteristics, these switches can be used in many selecting and monitoring operations. These switches feature remote control, 115 v., 60 cycle solenoid operation.

One of the series, the Type D, is fully automatic with the switch ro-



tated to positive position by the remote selector. Ideally suited for use in antenna array monitoring systems, this switch is a single-circuit, six-position unit which has been designed for use with RG-8/U cable.

Designers for Industry, Inc., 2915 Detroit Avenue, Cleveland 13, Ohio, will forward a specification sheet on this series upon request.

HOME RECORDER

Universal Microphone Company of Inglewood, California has just announced a new home recording unit that incorporates many professional features.

Designated the *Universal* RC Recording Chassis, this new unit offers the advantages of recording extremely close tangency; patented pantographic movement for equally spaced cutting over the entire record; visible groove depth adjustment; pantographic action keeping guide shoe at correct angle in lead screw thread; a lift lever at side of head allowing the operator to locate the stylus in the exact groove location after the lead screw has been

engaged; recording of music and voice at commercial levels and loudness; and a recording head which automatically lifts at the end of a 10" record.

The recording unit comes complete with a crystal pickup to play back 12" records.

For further information on this home recorder interested persons should write to *Universal Microphone Company,* Centinela at Warren Lane, Inglewood, California.

CROSSHATCH GENERATOR

A new television service instrument by means of which the serviceman can quickly and accurately check and adjust the linearity of a receiver's vertical and horizontal sweep without depending on the test charts from a television station, has been developed by *Philco Corporation* of Philadelphia.

Known as the *Philco* "Crosshatch Generator," Model 5072, this instrument is normally adjusted to produce 12 horizontal lines and 16 vertical lines on the picture tube. Readjustment is seldom necessary, but should it be required, the number and position of the vertical lines can be changed by a trimmer while a potentiometer adjustment for horizontal lines is provided.

By means of an adapter harness, the "Crosshatch Generator" obtains the required plate power, filament power, and synchronizing voltages from the television receiver being adjusted. The harness now supplied with the adapter is for use with *Philco* TV receivers, while harnesses for other makes will be available soon.

Additional information on the Model 5072 may be secured from *Philco Corporation,* Philadelphia, Pennsylvania.

TV CONDENSERS

Cornell-Dubilier Electric Corporation has added a new unit to its rapidly increasing line of condensers specifically designed for television applications.

The new unit, the Type TMC-187, is extremely compact and is rated at .005 μfd., 350 volts d.c. Dimensions

are 1 1/16" in diameter and 1¾" in length. The unit is also available in both single and dual capacities and other voltage ratings with small physical dimensions.

The Type TMC-187 is housed in a hermetically sealed cylindrical metal container, a wax impregnated cardboard sleeve with rolled over ends insulates the case. The condenser is self-mounted on No. 18 solid tinned copper wire leads.

Additional data on the Type TMC-187 and other units in this line of television condensers may be secured from *Cornell-Dubilier Electric Corporation,* South Plainfield, New Jersey.

SERVICE INSTRUMENT

Jorde Instruments Corporation has introduced a new radio test instrument for the serviceman.

Known as the *Jorde* "Master," the instrument incorporates fourteen needed servicing instruments into a single unit. The instrument includes a signal tracer which feeds through a high gain amplifier with the output through a 12 inch speaker; a 12 inch test speaker which may be used as substitute for field coils, voice coils, output transformers, filter chokes or an entire speaker; an audio amplifier having two inputs with means for checking microphones and phono pickups; an electrolytic substitution bridge where any single, double, and triple capacity units can be obtained; an electrostatic substitution bridge; a resistance substitution bridge; a 6 volt d.c. power supply; a 500 volt d.c. filtered power supply; a 1½ volt 90 volt power supply; a v.o.m.; an audio transformer substitution section; a voltage divider system; a condenser checker; and double duplex outlets for a.c. operation of equipment.

A pamphlet describing this instrument may be obtained on request from *Jorde Instruments Corporation,* Blytheville, Arkansas.

NEW UTC LINE

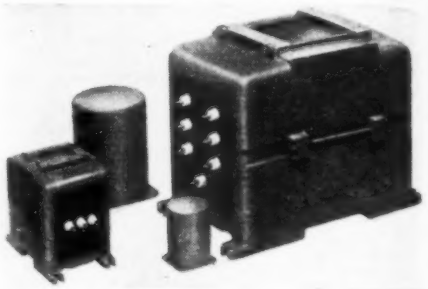
A new series of commercial grade components has been announced by *United Transformer Corporation* of New York.

These new transformers have been developed to meet the requirements of industrial electronics as well as those of the discriminating ham and p.a. man. The line includes audio components, input transformers, modulation, power, and filament transformers.

These new "CG" units are conservatively designed with low temperature rise and good insulation factors to assure dependability in continuous service. All coil structures are vacuum impregnated, and cases are poured with special sealing compounds to assure stability under adverse climatic conditions.

The series includes audio components for all applications ranging from low level; humbucking; multiple alloy shielded input transformers to 600 watt "varimatch" modulation transformers. Power and filament components range up to those required for a 3000 volt, 1 ampere plate supply.

Catalogue PS-408 covering the "CG"



series is available upon request to *United Transformer Corporation,* 150 Varick Street, New York 13, New York.

RCA MAGNIFIER

An ingenious new television picture magnifier that enlarges the images received on seven or ten-inch television picture tubes to the approximate equivalent in size and brilliance of

(*Continued on page* 160)

"ARROW" leads with Better Buys!

COMMAND RECEIVERS (274N Series)—Complete with Tubes

	NEW
BC-946-B; 520 to 1500 KC.	$12.95
BC-453-A; 190-550 KC.	6.95
BC-454-A; 3 to 6 MC.	5.95
BC-455-A; 6 to 9 MC.	5.95

COMMAND TRANSMITTERS (274N Series)—Complete with Tubes and Crystal

	USED	NEW
BC-457; 4 to 5.3 MC.		$5.95
BC-458; 5.3 to 7 MC.	$3.95	5.95
BC-459; 7 to 9.1 MC.	3.95	5.95

BC-456 MODULATOR . . . BRAND NEW . . . $2.95

DYNAMOTOR
DM 32A. Each 95c; 3 for $2.00

AN18/APT-10
Pre-amplifier Model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch, brand new in original cartons.
Each **$1.95** 3 for **$5.00**

CROSS POINTER INDICATOR
Two 0-200 microampere movement, three inch case, many applications, A-1 condition. SPECIAL, each **95c**

REMOTE CONTROL BOX
BC-450-A $1.95

ARB AIRCRAFT RADIO RECEIVER
The ARB is a six tube, four band, superheterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles. Used **$15.95**

AUTOMATIC FREQUENCY CONTROL UNIT
Western Electric type used for controlling frequency for teletype and telephone work, complete with 3—6SJ7 and 2—6H6 tubes. Complete unit, brand new in original box . . . **$4.95**

BC-604 FM 35 WATT TRANSMITTER
A-1 condition, complete with tubes, 10 channel push buttons, less crystals and power supply, each **$10.95**
Set of 80 crystals for above $14.95
BC-603 Receiver for above 10.95

TRANSFORMER
High voltage scope transformer, 90V 60 cps, primary: 6400V secondary: 4 stand-off terminals . . . . . each **$2.95**

ANTENNA TRANSFER SWITCH SW-225
Triple-pole double-throw, mounted on bakelite base with nine 2" porcelain stand-off mounts. BRAND NEW **59c**

BC-732 CONTROL BOX
With 6 position, selective switch, volume control and toggle switch . . . . . each **59c**

COAXIAL CABLE
26 ft. of Coaxial Cable RGU8, 52 ohm 89c

OUTPUT TRANSFORMERS
6V6 . . . . . 39c

FILTER CHOKES—All Fully Enclosed
3.7 H. @ 145 MA. DC., 125 ohms DC. Res. 4 MTG. Studs, each **59c**
100 mi 10H 59c

AN/PRS-1 MINE DETECTOR—BRAND NEW
. . . . . $9.50
PE-103 DYNAMOTOR . . used 5.95

BC-929-A
Contains power supply 110 V. 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes. Each $17.95; Used, ea $14.95

R-78/APS-15
Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes. Each **$39.50**

BENDIX COMPASS RECEIVER MN-26
Remote control commercial type navigational receiver. Indicates direction of any desired transmitting station. 3 bands—frequency range: 150 Kc to 1500 Kc; has 12—6 V. type tubes. Brand new, original cost $600. Now **$24.95**
Accessories for Above:
Loop MN-20 . . . . . $6.95
MN-28 Control Box 5.95
MN-52 Loop Control Unit 1.95

T-17B HAND MIKE
BRAND NEW . . . perfect carbon hand mikes, light wt., 200 ohms, single button, press to talk switch, 5 ft. rubber cord, plug, dust cover. ONLY **69c**

VHF RECEIVER BC-701
Frequency range 170-180 Mc; IF 30.5 Mc; complete with 11 tubes; self-contained power supply; brand new in beautiful wooden carrying case **$9.95**

NAVY GLIDE PATH RECEIVER
Bolt type, complete with 3—6C6 tubes and tune from 90 to 95 Mc; operates from 12 or 24 V. Brand New **$2.95**

VHF TRANSMITTERS
T-26/APT-2 = 450 — 710 mc = $ 9.95
T-27/APT-3 = 85-135 mc = 10.95
Above transmitters are amplitude modulated radar transmitters. Complete with all tubes such as 829, 832, 931, 6AC7, 6AG7, 5R4GY. Also 110 volt 400 cps. power supply. Brand new in original cartons. Manuals included.

GF12 and RU 17 NAVY RECEIVER and TRANSMITTER
Complete with receiving and transmitting coils, junction box, control boxes, plugs, power supply, instruction manual and spare parts which include tubes. Freq. Range: 200 Kc to 14 Mc. Brand new in original carton. A real buy **$24.95**

GO-9
Navy type low and high frequency transmitter with power supply an tubes. Operates from 200 Kc to 18,100 Kc; requires 115V, 800 cycles. Used. Complete with tubes **$29.50**

RCA AVT-112A—AIRCRAFT TRANSMITTER
For radio-telephone communication; for 6, 12 or 24 volt source freq. range from 2,500 to 6,500 Kc. Small in size and wt. (wt, 6 lbs.). Complete with 6 tubes, oscillator circuit, power amplifier modulators, dual tuning indicator and amplifier, with instruction manual, less crystal. BRAND NEW in ORIGINAL CARTONS— ONLY. Each **$12.95**

ALTIMETER TRANSCEIVER RT-7/APN-1
Frequency 418-462 Mc FM, with 14 tubes: 3—12SJ7; 4—12SH7; 2—12H6; 1—VR150; 2—955; 2—9004; 27 V. Dynamotor, used in working condition **$7.95**

RECEIVER-POWER SUPPLY UNIT
For the APN-4 indicator; complete with 16 tubes; 110 V. 400 cycles. BRAND NEW **$10.95**

MONTHLY SPECIALS

WAVE METERS
Freq. range: 22 to 30 meg $12.95
Freq. range: 37 to 53 meg 12.95
Freq. range: 155 to 230 meg 12.95
AC operated, complete with carrying case and magic eye for tuning indicator, veneer tuning dial.

BC-966
VHF receiver-transmitter unit; freq. range 157-200MC. A-1 condition **$3.95**

KEYERS
Audio amplifier—10 watts, 110V, 60 cycle, used for code practice, complete with tubes and photo electric cell—used—A-1 condition **$9.95**

450-TH TRANSMITTING TUBE
Each $9.95

PORTABLE FIELD TELEPHONE EE-8
Used, Each $4.95

All shipments F.O.B. Chicago—20% Deposit Required on all orders. Minimum order accepted $5.00.

SETCHELL CARLSON RADIO RECEIVER
Designed to receive A-N beam signals. 24-28 vdc 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier, 28D7, output amplifier, 195 to 420 kc. 4" high x 4" wide x 6⅝" long—wt. 3 lbs., 4 oz. Used, A-1 cond. **$2.95**
BRAND NEW in original carton $5.95

RADIO TRANSMITTER and RECEIVER APS-13
Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5—6J6, 9—6AG5, 1—VR105, 2—D21, unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF ONLY **$10.95**
Rack for above $1.95
Antenna for above 1.95

GLIDE PATH RECEIVER R-89/ARN-5
Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6AJ5, 1—12SH7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522KC, 6457KC units are in A-1 condition for ONLY **$6.95**
Complete with Tubes and Crystals

BC-733 D LOCALIZER RECEIVER
Freq. 108-110 Mc; Tube complement: 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—AH7GT, 2—12SG7, 3—717A; NOW ONLY **$6.95**
Complete with Tubes and Crystals

BC-625
VHF transmitter, frequency range 100-156 Mc., four channels. Part of SCR-522. Complete with tubes less crystals. Used, good condition. Each **$6.95**

AM-61 INDICATOR AMPLIFIER
15 tubes including two VR105; 6L7GT; 6SN7GT; with blower motor, brand new in original carton, with metal cover, each **$9.95**

VEEDER-ROOT METER AND CASE
Counts up to 1000. Each **59c**

WESTON OUTPUT METER No. 687
3 scales 0-50. A-1 Condition. ONLY $5.95

HAND-TYPE MICROPHONE RS-38
Carbon type, with PL-68 plug, brand new . . . $1.95
Used 1.00

BC-645 TRANSMITTER-RECEIVER
BRAND NEW . . . 15 tubes interrogator-transmitter designed for airborne use, 435 to 500MC frequency range. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band: 420-450mc; fixed and mobile: 450-460mc; citizens radio band: 460-470mc; television experimental; 470-500mc; complete with all tubes, including WE Doorknob tube. Size 10½x13½x4¾". Net wt. only 25 lbs. Your cost . . . . . only **$9.95**
DYNAMOTOR FOR ABOVE Model PE-101-C $2.95

RADIO PARTS
Assorted—100 mica condensers **$1.19**
100 Resistors ½ to 1 watt **95c**
100 Tubular bypass condensers, assorted .01 to .1, all 600 Volt **$4.69**
Electrolytic condensers 50-30, 150 Volt . . . . . 10 for **$2.89**
½ Meg. Volume Controls 1" shaft with switch. 10 for **$3.00**
½ Meg. Volume Controls 1" shaft without switch. 10 for **1.95**
Crystal Pick-up, new light wt . . . . . each **1.79**

400 CYCLE AUTOSYN MOTOR
Ideal for indicating direction of antenna systems—BRAND NEW . . . . . each **$2.95**

HEADPHONES
Signal Corps, 8000 ohms or 200 ohms, each . . . . . used **79c**

ARROW SALES, INC.

SOUTH SIDE BRANCH
8310 SOUTH HALSTED ST.

MAIN OFFICE
59 WEST HUBBARD ST., CHICAGO 10, ILL.
Telephone SUPerior 5575

NORTH SIDE BRANCH
1802 NORTH HUMBOLDT BLVD.

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 82 AND 83)

CROSLEY MODELS 88TA, 88TC

Part No.	Code and Description.
AC-137783	1—Trans. assembly, antenna (FM)
AC-138819	2—First i.f. trans. assembly
AC-139094	3—Second i.f. trans. assembly
AC-139077	4—Disc. trans. assembly
AW-138924	5—B. c. osc. coil assembly
AW-138950	6—Osc. mixer coil assembly
AW-138978	7—FM osc. plate choke assembly
AW-139056	8—.01 μfd., 200 v. cond. assembly
AW-136720	9A, 9B—R.f. heater choke assembly
AB-139118	10—Antenna loop & support assembly
Part of 1	11—Coil assembly
Part of 1	12A, 12B—Two-section coil assembly
AD-138246	13—Speaker
C-139028	14A, 14B—Two-section var. cond.
B-137364	15—Output trans.
B-137781	16A, 16B—1 megohm vol. control & sw.
B-137782	17—2 megohm tone control
B-137976	18A, 18B, 18C, 18D—50/50/50/20 μfd., 200/200/150/25 v. 4-section filter cond.
B-137986	19—Band change sw.
W-48858	20—Type 47, 6.3 v. @ .15 amp. dial bulb
39012-70	21—Iron core FM osc. coil
AB-138971	22—Interlock assembly
C-132300-6	23—Power cable & plug assembly
W-137143	25—75 ohm transmission line
W-139286	26—FM osc. coil
39373-9	27—47 ohm, ½ w. res.
39373-93	28—1.2 megohm, ½ w. res.
39373-143	29—1000 ohm, 1 w. res.
39373-16	30—150 ohm, ½ w. res.
39373-33	31, 32, 33, 34, 35—1000 ohm, ½ w. res.
39373-54	37, 38—10,000 ohm, ½ w. res.
39373-64	39—33,000 ohm, ½ w. res.
Part of 3	40—47,000 ohm, ½ w. res.
39373-67	41—47,000 ohm, ½ w. res.
Part of 4	42, 43, 44—100,000 ohm, ½ w. res.
39373-84	46—330,000 ohm, ½ w. res.
39373-87	47—470,000 ohm, ½ w. res.
39373-92	48, 49—1 megohm, ½ w. res.
39373-97	50—2.2 megohm, ½ w. res.
39373-102	51—4.7 megohm, ½ w. res.
W-139035	52—80/18 ohm, two-section wirewound res.
39001-17	54, 55, 61, 62, 63—.05 μfd., 600 v. cond.
39001-13	56, 57, 58, 60—.01 μfd., 600 v. cond.
39001-19	64—.1 μfd., 600 v. cond.
39001-76	65—.003 μfd., 600 v. cond.
39001-80	66—.02 μfd., 600 v. cond.
Part of 3	67, 68—100 μμfd., 300 v. cond.
Part of 2	69—100 μμfd., 300 v. cond.
C-137727-8	70, 71, 72, 73, 74, 76, 77—1000 μμfd., 300 v. cond.
Part of 4	75—1000 μμfd., 300 v. cond.
Part of 10	78—1000 μμfd., 300 v. cond.
C-137727-19	79—39 μμfd., 300 v. cond.
Part of 4	80—50 μμfd., 500 v. cond.
C-137727-24	81—180 μμfd., 500 v. cond.
C-137727-28	82—51 μμfd., 500 v. cond.
C-137727-37	83—10 μμfd., 300 v. cond.
Part of 4	84—10 μμfd., 300 v. cond.
B-137499-5	85—500 μμfd., 300 v. silver mica cond.
Part of 6	86—3.3 μμfd., 500 v. cond.
W-139285	87—52 μμfd. ceramic cond.
W-138268	88—Trimmer cond.
C-13627-29	89—Trimmer cond.
Part of 1	90, 91—Trimmer cond.
Part of 2	92, 93, 96, 97—Trimmer cond.
Part of 3	94, 95, 98, 99—Trimmer cond.
Part of 4	100, 101—Trimmer cond.
Part of 6	102—47,000 ohm, ½ w. res.
39001-11	103—.005 μfd., 600 v. cond.
39373-74	104—100,000 ohm, ½ w. res.
C-137727-8	105—1000 μμfd., 300 v. cond.
39373-92	107, 108—1 megohm, ½ w. res.
Part of 10	109—1 megohm, ½ w. res.

WARDS MODEL 74BR-2003B

Part No.	Code and Description.
C-9B1-90	R_1—220,000 ohm, ½ w. res.
9B1-78	R_2—22,000 ohm, ½ w. res.
C-9B1-91	R_3—270,000 ohm, ½ w. res.
C-9B1-47	R_4—56 ohm, ½ w. res.
C-9B2-44	R_5—33 ohm, 1 w. res.
C-9B1-93	R_6, R_{12}—360,000 ohm, ½ w. res.
A-10A-12634	R_7, S_1—1 megohm vol. control & sw.
C-9B1-34	R_8—3.3 megohm, ½ w. res.
C-9B1-36	R_9—6.8 megohm, ½ w. res.
A-11B-12659	R_{10}—1 megohm tone control
C-9B1-86	R_{11}—100,000 ohm, ½ w. res.
C-9B1-52	R_{13}—150 ohm, ½ w. res.
C-9B1-43	R_{14}—27 ohm, ½ w. res.
C-9B2-54	R_{15}—220 ohm, 1 w. res.
C-9B2-63	R_{16}—1200 ohm, 1 w. res.
C-8G-11734	C_1—100 μμfd. ceramic cond.
C-8F3-124	C_2—820 μμfd., 300 v. mica cond.
A-2M-12618	C_3, C_5—Plate trimmer
C-8G-12198	C_4—47 μμfd. ceramic cond.
C-8D-10770	C_6—.05 μfd., 200 v. cond.
C-8D-11251	C_7—.09 μfd., 400 v. cond.
B-13A-13071	C_8, C_9, T_1—Input i.f. coil
C-8D-10771	C_{10}—.1 μfd., 200 v. cond.
C-8D-10813	C_{11}—.05 μfd., 400 v. cond.
B-13B-13072	C_{12}, C_{13}, T_2—Output i.f. coil
C-8D-10761	C_{14}, C_{15}, C_{23}—.01 μfd., 400 v. cond.
C-8F3-10	C_{15}, C_{16}—220 μμfd., 300 v. mica cond.
C-8D-12243	C_{17}—.006 μfd., 600 v. cond.
A-8C-11678	C_{19}—25 μfd., 25 v. elec. cond.
A-8C-10077 or A-8C-10937	C_{20A}, C_{20B}, C_{20C}—40/20/20 μfd., 150/150/150 v. filter cond.
B-12C-12356	T_3—Output trans. for speaker
B-18A-12839-1	T_4—PM speaker
A-13E-12668	L_1—Antenna tuning coil
A-23D-12667	L_2—Osc. tuning coil
B-13D-12371	L_3—Osc. shunt coil assembly
C-13E-13305	L_4—Loop antenna assembly
A-20A-12653	S_2—Radio-phono sw.

HOFFMAN MODEL A700

Part No.	Code and Description.
4535	R_1, R_{14}—3.3 megohm, ½ w. res.
4502	R_2, R_7, R_9, R_{16}—2.2 megohm, ½ w. res.
4514	R_3—680 ohm, ½ w. res.
4506	R_4—.47 megohm, ½ w. res.
4513	R_5, R_{15}—1 megohm, ½ w. res.
4511	R_8, R_{10}—.1 megohm, ½ w. res.
4527	R_8—3900 ohm, ½ w. res. ± 10%
4808	R_{11}—1 megohm pot. & vol. sw.
4505	R_{12}—10 megohm, ½ w. res.
4533 or 4542	R_{13}—820 ohm, ½ w. res. ± 10%
	R_{13}—1000 ohm, ½ w. res. ± 20%
4534	R_{17}—1500 ohm, ½ w. res.
4532	R_{18}, R_{22}—47 ohm, 2 w. res.
4522	R_{19}—1000 ohm, 1 w. res.
4701	R_{20}—1500 ohm, 6½ w. wirewound res. ± 5%
4531	R_{21}—470 ohm, 1 w. res. ± 10%
Part of C_2, C_8	C_1, C_7—Trimmer
4401	C_2, C_6—388/180 μμfd. two-section var. cond.
4306	C_3—60/260 μμfd. mica trimmer
4000	C_4, C_9, C_{11}—.0001 μfd. mica cond.
4009	C_8—47 μfd. mica cond.
4112	C_{24}, C_{25}—.01 μfd., 400 v. cond.
4102	C_{10}, C_{12}, C_{13}, C_{14}—.005 μfd., 600 v. cond.
4202	C_{15}, C_{16}—100 μfd., 25 v. dry elec. cond.
4100	C_{17}, C_{18}, C_{20}, C_{21}—.05 μfd., 200 v. cond.
4201	C_{18}, C_{26}—30/50 μfd., 150/150 v. dry elec. cond.
4108	C_{22}, C_{23}—.2 μfd., 220 v. cond.
4101	C_{24}—.05 μfd., 400 v. cond.
55208	L_1—Antenna loop
5250	L_2—Antenna loop compensator
5243	L_3—Permeability tuned r.f. coil
6010	S_1—Power-battery sw. S_2—On-off sw. (on vol. control)
5242	T_1—Input i.f. trans.
5243	T_2—Output i.f. trans.
5104	T_3—Output audio trans.
5244	T_4—Osc. coil
9517	Rect.—Selenium rectifier

PILOT MODEL T-601 TUNER

See diagram for circuit values

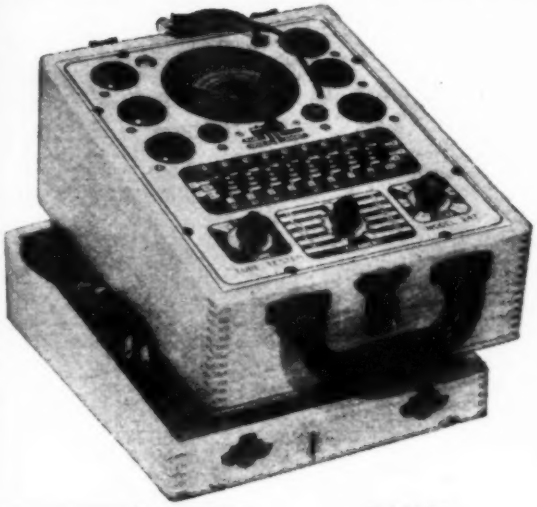
ZENITH MODEL 5G036

Part No.	Code and Description.
63-654	R_1—180,000 ohm, ¼ w. res.
63-646	R_2—33,000 ohm, ¼ w. res.
63-600	R_3—2.2 megohm, ¼ w. res.
63-1236	R_4—Vol. control & sw.
63-594	R_5—68,000 ohm, ¼ w. res.
63-587	R_6—4700 ohm, ¼ w. res.
63-976	R_7—15 megohm, ¼ w. res.
63-271	R_8—1 megohm, ¼ w. res.
63-1558	R_9—820 ohm, 1 w. wirewound res.

SENSATIONAL VALUES

THE NEW MODEL 247

TUBE TESTER



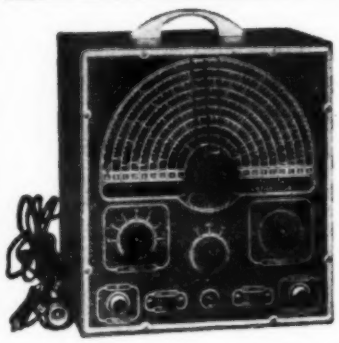
FEATURES: The Model 247 incorporates a newly designed element selector switch which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap."

The new free-point system described above permits the Model 247 to overcome the difficulties encountered with other emission type tube testers when checking Diode, Triode and Pentode sections of multi-purpose tubes, because sections can be tested individually when using the new Model 247. The special isolating circuit allows each section to be tested as if it were in a separate envelope.

The Model 247 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R. M. A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Model 247 comes complete with new speed-read chart. Comes housed in handsome, hand-rubbed oak cabinet sloped for bench use. A slip-on portable hinged cover is included for outside use. Size: 10¾" x 8¾" x 5¾".

ONLY **$29.90** NET



The New Model 650

SIGNAL GENERATOR

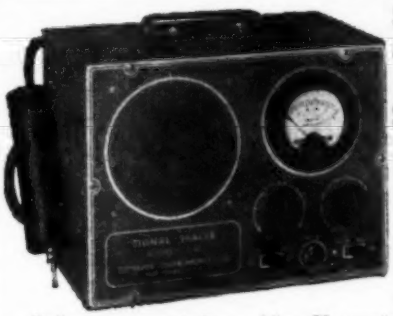
RANGES:

100 Kilocycles to 35 Megacycles on Fundamentals

25 Megacycles to 105 Megacycles on Harmonics

- ★ R. F. obtainable separately or modulated by the Audio Frequency.
- ★ Audio Modulating Frequency—400 cycles pure sine wave—less than 2% distortion.
- ★ Attenuation—3-step ladder type of attenuator (T pad).
- ★ Uses a Hartley Exciter Oscillator with a Buffer Amplifier.
- ★ Tubes: 6J5 as R. F. Oscillator; 6AS7 as Modulated Buffer and Mixer; 6SL7 as audio oscillator and rectifier. Complete with coaxial cable, leads and instructions.....

REDUCED FROM $48.75 To **$39.95**



SEE and HEAR the Signal with the new

CA-12

SIGNAL TRACER

FEATURES:

* Comparative intensity of the signal is read directly on the meter —Quality of the signal is heard in the speaker.
* Simple to operate — Only one connecting cable—No tuning controls.
* Highly sensitive—Uses an improved vacuum-tube voltmeter circuit. * Tube and resistor capacity network are built into the detector probe. * Built-in high gain amplifier—Alnico V speaker. * Completely portable—Weighs 8 pounds—measures 5½" x 6½" x 9".

Complete with self-contained batteries and instructions.....Reduced from $34.85 to **$29.95**

The New Model 670 SUPER METER

A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500.—A.C. VOLTS 0 to 15/30/150/300/1500/3000 Volts.—OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000.—D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps.—RESISTANCE: 0 to 500/100,000 ohms, 0 to 10 Megohms.—CAPACITY: .001 to .2 Mfd., 1 to 4 Mfd. (Quality test for electrolytics).—REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.—INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries. DECIBELS: −10 to +18, +10 to +38, +30 to +58.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

AVAILABLE FOR IMMEDIATE SHIPMENT FROM STOCK—20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

MOSS ELECTRONIC DISTRIBUTING CO.

DEPT. RN-3, 229 FULTON STREET
NEW YORK 7, N.Y.

63-1099	R_{10}—33 ohm, ½ w. wirewound res.
63-1366	R_{11}—140 ohm, 2 w. wirewound res.
63-1239	R_{12}—Candohm
63-439	R_{14}—2700 ohm, ¼ w. res.
63-627	R_{15}—180 ohm, ¼ w. res.
22-1216	C_1—Two-section var. cond.
22-1183	C_2—.01 μfd., 400 v. cond.
22-829	C_4—.05 μfd., 200 v. cond.
22-162	C_6—.0001 μfd., 600 v. cond.
22-827	C_7—.1 μfd., 200 v. cond.
22-1027	C_8, C_9—20/20 μfd., 150/150 v. elec. cond.
22-1017	C_{12}—.05 μfd., 400 v. cond.
22-470	C_{13}—.00015 μfd., 600 v. cond.
22-196	C_{16}—.01 μfd., 600 v. cond.
22-182	C_{17}—.00025 μfd., 600 v. cond.
22-492	C_{18}—.002 μfd., 600 v. cond.
22-887	C_{19}—.001 μfd., 600 v. cond.
22-448	C_{20}—.004 μfd., 600 v. cond.
22-1026	C_{21}, C_{22}—20/40 μfd., 150/150 v. elec. cond.
22-303	C_{23}—5 μμfd., 600 v. cond.
95-816	T_3—First i.f. trans.
95-817	T_5—Second i.f. trans.
S-11960	L_1—Antenna coil assembly
S-12505	L_2—Osc. coil assembly
85-284	S_1—Radiorgan sw. (voice & alto)
85-288	S_2—Radiorgan sw. (treble & bass)
85-254	S_3—Power changeover sw.

TRUETONE MODEL D2815

Part No.	Code and Description.
C-9B1-62	R_1—100 ohm, ½ w. res.
C-9B1-70	R_2—4700 ohm, ½ w. res.
C-9B1-80	R_3—33,000 ohm, ½ w. res.
C-9B1-78	R_4—22,000 ohm, ½ w. res.
C-9B1-34	R_5—3.3 megohm, ½ w. res.
C-9B1-90	R_6, R_{11}—220,000 ohm, ½ w. res.
C-9B1-82	R_7—47,000 ohm, ½ w. res.
A-10A-11603	R_8, S_1—1 megohm vol. control & sw.
C-9B1-53	R_9—180 ohm, ½ w. res.
C-9B1-35	R_{10}—4.7 megohm, ½ w. res.
C-9B1-94	R_{12}—470,000 ohm, ½ w. res.
C-9B2-52	R_{13}—150 ohm, ½ w. res.
C-9B1-91	R_{14}—270,000 ohm, ½ w. res.
C-9B1-3	R_{15}—22 ohm, ½ w. res.
C-9B2-54	R_{17}—220 ohm, 1 w. res.
C-9B2-63	R_{18}—1200 ohm, 1 w. res.
C-9B2-44	R_{19}—33 ohm, 1 w. res.
C-8D-10778	C_1, C_{15}—.002 μfd., 600 v. cond.
C-8F3-8	C_2, C_5, C_9, C_{11}, C_{13}—100 μμfd., 500 v. mica cond.
B-8A-10827	C_{3A}, C_{3B}, C_4, C_7—Two-gang cond. assembly (including trimmers)
C-8D-10771	C_8—.1 μfd., 200 v. cond.
C-8D-10770	C_9—.05 μfd., 200 v. cond.
C-8F3-10	C_{10}—220 μμfd., 500 v. mica cond.
C-8D-10761	C_{14}, C_{23}—.01 μfd., 400 v. cond.
C-8D-10785	C_{16}—.006 μfd., 600 v. cond.
C-8D-10760	C_{17}, C_{19}—.1 μfd., 400 v. cond.
A-8C-10077	C_{18A}, C_{18B}, C_{18C}—40/20/20 μfd., 150/150/150 v. elec. cond.
C-201-10908-1	T_1—Loop antenna assembly
A-16A-10792	T_2—R.f. choke coil
A-13D-10661 or A-13D-12082	T_3—Osc. coil
B-13B-10091-1	T_4—Input i.f. trans.
B-13B-10092-1	T_5—Output i.f. trans.
B-12C-10623	T_6—Output trans. for speaker
B-18A-10647	T_7—Oval PM speaker
A-16A-12164	T_8—1 f. choke coil

—30—

PRODUCTION HITS NEW PEAK

FIGURES released by the Radio Manufacturers Association on radio receiver production indicates that the industry enjoyed another record breaking month in November.

Production of FM-AM radio receivers topped all previous records with a total of 153,114 units of this type. Television receivers hit a new high for a single month with 24,135 sets reported by member-companies.

Total radio and television set production by RMA manufacturers numbered 1,615,541 in November and brought the year's eleven-month total to 15,989,759. The November FM-AM set production was at an annual rate of two million receivers and was 102.9 per-cent above the previous 1947 weekly average output.

The FM-AM sets included 40,198 table models, 5660 converters and tuners, 1892 consoles, 1007 table model radio-phonograph combinations, and 104,357 radio-phonograph consoles. —30—

TERMS: CASH WITH ORDER

AMERICAN SURPLUS PRODUCTS CO.
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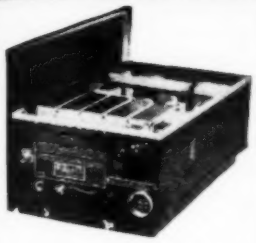
WAR SURPLUS BARGAINS!



R5/ARN-7 RADIO COMPASS RECEIVER

Three bands 200 to 1750 KC. Complete with 17 tubes required. This set is ideal for conversion to home broadcast receiver, addition to ham shack, etc. Reported sold for many times the price when brand new. A receiver that would be hard to pick up at this price.

Control head available for above $4.95.

Only **$31.50**

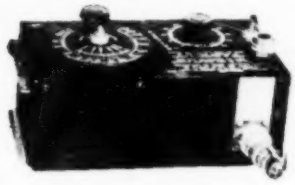
ALTIMETER

Sensitive Altimeter

$12.50 ea.

MAGNETIC COMPASS

$6.00 ea.

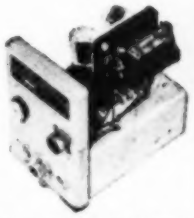


INTERVALOMETER

Electronic timing device for releasing bombs at preset intervals. Ideal for dark room timer, model train controller, etc. Contains relays, switches, pilot light, resistors, knobs, etc. Approximate weight, 7 lbs.

$1.95

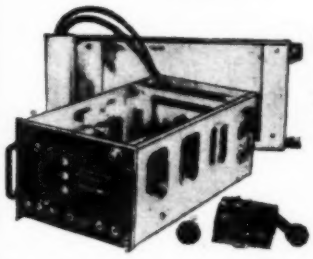
MARKER BEACON RECEIVER



Ideal for controlling remote circuits for model aircraft, boats, etc. Operates from 75 mc. Signal easily altered to 2 meter band. Tubes used and included: 1—6SH7, 1—6SL7-GT, 1—12SN7GT. Also sensitive relay. Circuit diagram included inside case. Size 5⅛"x3⅛"x 5¼". For 24 V. DC operation. Complete as shown. With case.

$3.95

ARC-4 TRANSMITTER AND RECEIVER



INCLUDING CASE

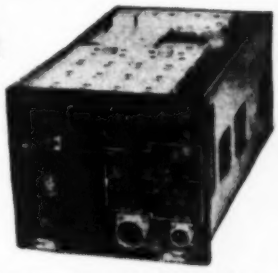
$19.75

Operates on any of its 4 predetermined crystal controlled frequencies in the range of 140 MC. Complete with tubes, remote control, junction box, shock mounting base and connecting plugs. This unit is ideal for amateur UHF or mobile telephone. Operates from self-contained 24 V DC dynamotor.

NAVY CRV-46151 AIRCRAFT RADIO RECEIVER

INCLUDING CASE

$19.50

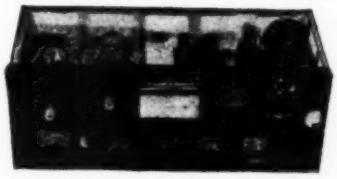


Four bands, including broadcast (195-9,050 KC). Circuit is six-tube superheterodyne with mechanical band change or remote operated electrical band change. Remote band change and tuning controls included, making this set readily adaptable to mobile ham use. Powered from self-contained 24 V DC dynamotor.

The sets are complete with tubes, mounting rack and remote controls. No cables.

Unless Otherwise Specified—the Advertised Equipment is Sold as Used . . .

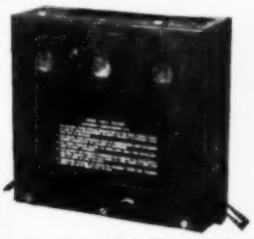
RADIO ALTIMETER APN/1



A complete 460 mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6, 1-VR150, 2-955, 2-9004. Other components such as relays, 24 V dynamotor, transformers, pots, condensers, etc., make this a buy on which you can not go wrong. Complete as shown in aluminum case 18 x 7 x 7¼.

$8.95

New WILLARD RECHARGEABLE STORAGE BATTERIES



New 6-volt battery in spill-proof clear plastic case, housed in metal case for easy mounting. Applicable for a wide range of uses where battery power is needed. Shipped dry. Uses standard battery electrolyte available everywhere.

Price, each	$4.00
Lots of Ten	3.35
Without metal case, each	3.00
Lots of Ten	2.85

OXYGEN TANKS

$5.95

These oxygen tanks, removed from surplus aircraft have a capacity of 500 lbs. Pressure. Type D2, with complete regulator assembly. Size of tank 22"x5".

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Enclose fee for parcel post with remittance

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INDIANAPOLIS, IND.

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TRANSMITTERS AND RECEIVERS FOR

10 Meter Mobile Rig

WAR SURPLUS SCR-274-N COMPLETE FOR ONLY

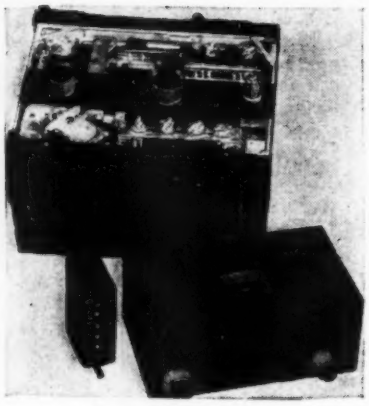
Conversion Book gives details for low-cost, easy conversion to

- **10 METER MOBILE RIG**
- **20—40—80 METER BANDS**

$19.50

This sensation of all surplus is not only an ideal 10 Meter Mobile Rig! It's a complete amateur radio station! Here are a few more ways to use the equipment included in this Command Set. The transmitter VFO driver stage gives your BC-375-E higher RF output—as high as 150 watts. Make swell standby receivers with the BC-348 on round-table "rag chews." You get all this equipment: 3 Receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors—28 volts DC input; 1 modulator with carbon mike input; two tuning control boxes; one antenna coupling box with r-f ammeter; antenna relay and 5000 volt 50 mmfd. WE vacuum condenser (antenna relay can be used with most rigs); and a complete set of tubes for each unit—29 POPULAR TUBES in all. Mechanical cables for remote tuning of receivers supplied for $1.00 extra.

FREE CONVERSION BOOK



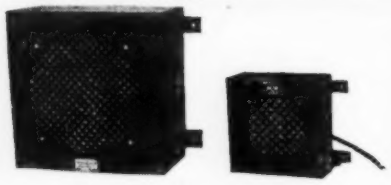
2 METER RIG AAF SCR-522

AAF SCR-522 designed to operate from 100-156 mc. makes ideal 2 meter rig (or 2-way mobile radio). Only two small changes incorporated converts to 6 meter operation. As mobile radio telephone unit the dynamotor can be converted to an engine-driven, self-excited generator or coupled to ¼ hp. AC motor for ground station power supply.

Transmitter and Receiver complete with tubes. **$17.50**

Trans-Rec., tubes, dynamotor, control box, plugs and conversion diagram book. **$24.50**

PE-98 DYNAMOTOR 12-volt input for use with the SCR-522 or any 12-volt equipment, ea. **Only $12.50**



HIGH FIDELITY SPEAKERS

6-inch, 10-watt PM Speaker, ea. **$7.95**

12-inch, 15-watt PM Speaker, ea. **$14.50**

Brand new in Heavy Duty Steel Cabinets with beautiful black wrinkle finish.

Also has T-pad volume control and 600 ohm line to speaker transformer. Wall mounting brackets and slope front.

FREE CONVERSION BOOK

with each of these specials or order your copy at **$2**

Gives data on conversion, with schematic diagrams, instructions, discussion.

Diagrams and Conversions on this War Surplus

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- SCR-274-10 met. mobile

Also diagrams for:

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- SCR-718
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LOOP LP-21

Shielded Loop Antenna Rotated by Selsyn motor. Has separate selsyn transmitter for remote indicator. Has a weather proof tear drop housing over loop.

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32 volt DC—2000 watt.....$74.50
115 volt 60 cy.—2500 watt.....$250.00

DIESEL POWERED

115-230 volt, 60 cy., 3 phase, 15 kw $1,800

MANY OTHER TYPES. WRITE US YOUR REQUIREMENTS.

Send for FREE Catalogue of Transmitter & Receiver Kits

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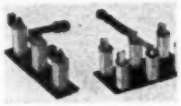
Carbon Mike T-17
Used, in A-1 condition
$1.00
BRAND NEW $1.50

Headphones 69c
HS-33 with cord and plug, 600 ohms — Used, in A-1 condition.

Headphone Extension Cords
25c
Approx. 72" long, rubber covered, with JK-26 and PL-55 plugs.

Headphone Adapters MC-385
From high to low impedance, 4000 ohms to 600 ohms. Contains matching transformer.
30c EACH
4 FOR $1.00



19c 29c
Antenna Switches
Single pole, double throw (left)
Double pole, double throw (right)

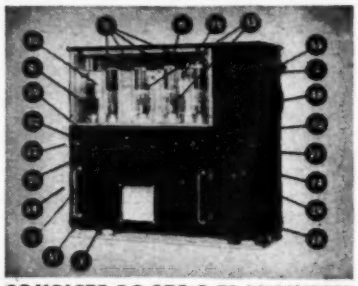
Antenna Switch
Triple pole, double throw
75c

WAR SURPLUS BC-375-E TRANSMITTER

With thousands of usable standard radio parts

$24.50 COMPLETE
(Gov't cost, $1800)
Wiring & Conversion Diagram **FREE**

PARTS ALONE WORTH HUNDREDS OF DOLLARS TODAY! Use it for parts or use it as a transmitter



COMPLETE BC-375-E TRANSMITTER

METERS
1. (1) 0-15V AC. DC., GE
2. (1) 0-8A RF with thermocouple, GE
3. (1) 0-500 MA. DC., GE

TUBES
4. (1) 10Y (VT-25)
5. (4) 211 (VT-4-C)

COILS
44. (3) RF chokes
45. (1) AF choke .5 hy .1 amp
46. (1) Parasitic Suppressor
47. (1) Tapped antenna loading coil on ceramic form

COILS *(continued)*
48. (1) Continuously variable antenna loading coil with dial-ceramic form

SWITCHES
21. (1) Interlock
22. (1) Test
23. (1) SPDT Toggle
24. (2) DPST Toggle
25. (1) 3 pos. Mallory w/bar knob
26. (1) SPDT Toggle
27. (1) 4 pos., 3 sec. hi voltage band switch w/bar knob
28. (1) 5 pos. hi voltage, band switch w/bar knob

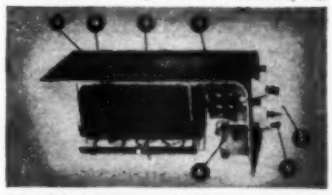
RESISTORS
6. (1) Tapped Resistor 2.7 ohms, 36 watts—3.7 ohms, 26 watts
7. (1) 5 ohms 2 watt, IRC
8. (2) 5 ohms 12 watt, IRC
9. (1) 50 ohms 4 watt, IRC
10. (1) 100 ohms 12 watt, IRC
11. (1) 150 ohms 8 watt, IRC
12. (1) 200 ohms 2 watt, IRC
13. (1) 200 ohms variable, Mallory
14. (1) 2500 ohms 15 watt, IRC
15. (2) 3000 ohms variable, Mallory
16. (1) 4000 ohms 15 watt, IRC
17. (3) 11000 ohms 12 watt, IRC
18. (1) 30000 ohms 1 watt, IRC
19. (1) 200000 ohms 1 watt, IRC
20. (4) 250000 ohms 1 watt, IRC

CAPACITORS
29. (1) 22-118 mmf. variable with vernier dial
30. (1) tube thermal compensating and calibration reset capacitor
31. (2) .0001-1000 V, CD, mica
32. (1) .006-2500V, CD, mica
33. (2) .001-2500V, CD, mica
34. (1) .001-4500V, CD, mica
35. (1) .02-1000V, CD, mica
36. (1) .01-1000V, CD, mica
37. (1) .01-2500V CD, mica
38. (3) 1-300V, CD, mica
39. (1) 1-1-1 3000V GE, pyranol
40. (1) 25 mfd 25V, CD, electrolytic

You get all this: transmitter, tubes, ant. loading unit, dynamotor, five tuning units:

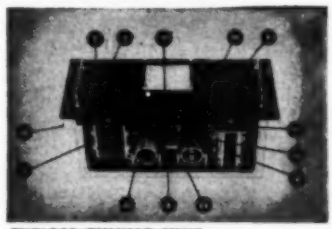
TRANSFORMERS
41. (1) Microphone trans. single button mic. to single grid
42. (1) Interstage transformer single plate to push-pull grids.
43. (1) Modulation transformer — class B mod. to class C plate

MISCELLANEOUS
49. (1) 8 contact antenna relay—28V D.C.
50. (2) Ceramic insulated flexible couplings
51. (1) 6.3V dial lamp and socket
52. (1) mic. jack
53. (2) .5A-1000V Fuses
54. (3) Sockets with plugs
55. (5) Binding posts
Plus hardware, stand-off insulators, etc.



BC-306-A ANTENNA LOADING UNIT
1. (1) 3 Gang, 5 position, high voltage band switch
2. (1) Tapped inductance with variometer tuning
3. (1) Vernier dial
4. (1) Ceramic insulated flexible coupling
5. (2) Bee-hive feed-thru insulators
6. (1) Capacitor .00024-6000V SANGAMO

SAVE C. O. D. CHARGES by remitting in full direct—or send 25% deposit with all orders. Shipment made direct from whse. in Okla., Ariz., Ark. or Virginia.

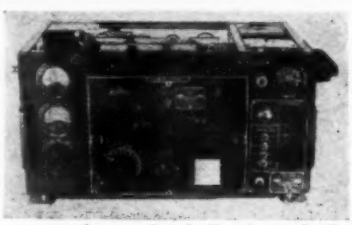


TYPICAL TUNING UNIT
TU-5-B—1500-3000 KCS
1. (2) Vernier dials
2. (1) Variable capacitor, 20-135 mmf.
3. (1) Variable capacitor, 20-156 mmf.
4. (1) Variable capacitor, 8-26 mmf.—neutralizing
5. (1) .00003-2000V capacitor, CD—mica
6. (3) .00009-3000V capacitor, CD—mica
7. (2) .0004-5000V capacitor, CD—mica
8. (3) .0001-3000V capacitor, CD—mica
9. (2) 4 position ceramic band switches
10. (2) 2 RF chokes
11. (1) Tank coil—ceramic form with tapped antenna coupling coil
12. (1) Tank coil—ceramic form
13. (1) Parasitic suppressor
14. (2) Ceramic flexible couplings
15. Plus banana jacks, stand-off insulators

PE-73 DYNAMOTOR
1. (1) Dynamotor 28V DC input—1000V DC output—GE
2. (1) Fuse, 30A 250V
3. (1) Fuse, 60A 250V
4. (1) Fuse, 1A 1000V
5. (1) Relay, 24V D. C.
6. (3) .005-5000V Capacitor, mica—CD
7. (1) .01-1000V Capacitor, mica—CD
8. (2) .01-600V Capacitor, mica—CD

R & M RADIO COMPANY

Dept. RN-38—1425 N. QUINCY ST., ARLINGTON, VIRGINIA



NAVY TRANSMITTER TYPE GP-7

Rated at over 125 watts, designed to cover from 350 to 9050 kc. with plug-in tuning units; one of the few transmitters on surplus market built of standard parts, making it a very unusual buy. Limited quantities. Transmitter, tubes and tuning unit— **Only $17.50**

CATALOGUES FREE! USE COUPON

R & M RADIO COMPANY, Dept. RN-38,
1426 N. Quincy St., Arlington, Va.

☐ Send Conversion Book. ☐ $2 inclosed. ☐ Send C.O.D.
Send FREE catalogue on
☐ Xmtr. Kits. ☐ Receiver Kits. ☐ Television Kits.
☐ I am a licensed amateur. ☐ Beginner.

Name.....

Address.....

City.....

Zone..... State.....

Direct Mail for Dealers

By GERALD SAMKOFSKY

A direct mail campaign pays real dividends. Try some of these tested techniques on your customers.

IT PAYS to advertise! This slogan has been bruited around for so many years that it has been accepted as a truism. It is time that the radio serviceman finds out just how advertising pays—and what type of advertising is best suited to his particular requirements.

By a queer quirk of fate, the writer has been engaged in both the radio servicing and the direct mail advertising field for some time. Out of the experience gleaned in both of these fields perhaps a few items might be of interest to the serviceman in evaluating his advertising budget.

There should be no disagreement among the users of the various types of advertising that the value of any particular media can only be measured by the results obtained! The ideal situation, of course, would be if each retailer could present his advertising message personally to his prospective customers, demonstrating the merchandise or service at the same time. Since this procedure is obviously impossible except to a very limited extent, the radio serviceman has to rely on other methods of telling his public of his services and capabilities.

Barring direct contact with the customer, one of the most personal approaches to selling your services or merchandise is the direct mail campaign. A carefully planned and successfully executed direct mail campaign injects a personal note into your customer relations which is hard to obtain in any other manner. In a direct mail campaign you, as a radio serviceman or dealer, can call your customer "by name" and, in effect, have a little "talk" regarding your services and merchandise.

The golden key to a succesful direct mail campaign is your mailing list. An accurate and up-to-date mailing list is a valuable business asset—so much so in fact that many companies exist solely on the business derived from supplying mailing lists to other firms. If you haven't been able to assemble your own mailing list it is possible to rent suitable lists. Such commercial lists are available in an almost infinite variety of classifications ranging from major industry groups to juveniles. In renting a listing for your direct mail campaign be sure that the list you seek contains the classifications suitable to the merchandise or service you are offering.

As an example, let us assume that "Best Radio Company" in a major city has just received a shipment of television receivers. Naturally, one of the new receivers will find its way into the company's display window—but obviously something more is needed to encourage customers to buy this item.

Not having a mailing list of their own, the "Best Radio Company" contacts a direct mail agency in its city. A suitable mailing piece is prepared telling of the arrival of the new merchandise and pointing out its advantages to the customer. Or maybe the company has decided to have a special television showing featuring a baseball game, boxing match, or movie premiere. In this case, carefully worded invitations are prepared asking the recipient to be present at the event. These invitations should not be sent haphazardly but should be forwarded to persons in the middle and upper income brackets for these are normally the people who will be in the market for television receivers.

Now assume that "Best Radio Company" has just received a shipment of small receivers closed out by a radio manufacturer. Here the problem is different. The problem is one of disposing of a large number of low priced items so the direct mail pieces are sent to a "general list" containing the names of persons in all income brackets. Since most direct mail experts can gauge the number of sales which will result from any given type of mailing, the proper coverage can be given to this sale to permit the disposal of all of the units in stock.

Direct mail can be used just as successfully in selling a service. "Black Radio Service," which specializes in radio servicing but sells no merchandise, decides on a direct mail campaign to increase its service business.

A flyer describing the servicing facilities of the company is sent to a selected list of persons in the *service area* of "Black Radio Service." Obviously, there is no advantage to be gained in circularizing large numbers of persons residing outside of the company's normal trading area, so the entire mailing is concentrated on a carefully selected section of the town or city. Since radio servicing is a vague sort of idea to most persons, the mailing pieces are dressed up with pictures, cartoons, etc. and written in non-technical language. In preparing such a flyer it should be remembered that to the average person money spent for radio servicing is money spent on an intangible—they can

BIG MONEY IN RADIO — FREE

COYNE'S New 5 Volume Set "APPLIED PRACTICAL RADIO"

JUST OFF THE PRESS! SEE IT FREE FOR 7 DAYS

You men who want to go places in Radio, and who know how much a solid working knowledge of the field helps to get the big money—this is IT! Over 1500 pages of down-to-earth Radio, from simplest principles to newest Television! It's all there easy to understand—how and why it works . . . how to construct, install, service. PA, short-wave, auto-radio, aviation, radio-phonographs, FM, testing instruments and trouble-shooting short-cuts, phototubes—you name it, COYNE'S got it, in "Applied Practical Radio"!

GET THIS BOOK FREE for LOOKING AT SET

Brand New! Explains circuits of latest sets.

PRACTICAL! CLEAR! COMPLETE!

5 big volumes—1000 illustrations and diagrams, with step-by-step photographs which "break down" the equipment for you to show what makes it "tick". Up-to-the-minute, complete, easy to follow . . . **written as only COYNE books are written!**

VALUABLE BOOK FREE for Looking at 5-Volume Set

You must SEE these books to know how easy it is to prepare for the big jobs in radio. Here's our special offer:—we'll send the complete 5-volume set for your 7-Day FREE Examination. And with it, we'll include our valuable, new guide for all radiomen, "150 New Radio Diagrams Explained", absolutely FREE! If you keep the 5-volume Set all you pay is $3.00 within 7 days after the books arrive and $3.00 per month until $16.75 is paid—or you can pay $15.00 cash price. If you don't want the set, return it and you OWE NOTHING. But either way you keep the "150 Radio Diagrams Book" as a gift. That book is ABSOLUTELY FREE.

SEND NO MONEY **REMEMBER—Coupon is not an order,** just a request to see set free and get the FREE BOOK. But **offer is limited,** so act at once!

Send This Coupon NOW

FREE BOOK

EDUCATIONAL BOOK PUBLISHING DIVISION
COYNE ELECTRICAL & RADIO SCHOOL
Dept. 38-T3, 500 S. Paulina St., Chicago 12, Ill.

O. K., send me postpaid your new 5-volume set, "**Applied Practical Radio**" on 7 days' free trial per your offer in Radio News. Be sure to include as a gift the book of **150 New Radio Diagrams Explained,** absolutely FREE.

NAME ..... AGE .....
ADDRESS .....
TOWN ..... ZONE ..... STATE .....

NEW GOVERNMENT SURPLUS PARTS

All Transformers 115-V 60 cycle

T-23—Sec. #7-6.3V-22.0 Amp. #2-6.3V-2.4 Amp. #5-6.3V-2.25 Amp. #4-6.3V-0.6 Amp. **$2.95**

T-7—Sec. #1-25V-6A-Hi Volt Insulation #2-6.3V-3A. Cased—N.S. ... **$2.50**

T-19—Sec. #1-300V-100 Mil. #2-22Vlt-100 Mil. #3-6.3V-3.5 Amp. #4-2.5V-10 Amp. (Hi-Insulation) **$1.95**

T-9—Sec. #1-360-0-360-350 Mil. Cased Famous Make—N.S. **$5.00**

T-24—Sec. #1-438-0-438-160 Mil. #2-5V-3 Amp. **$3.50**

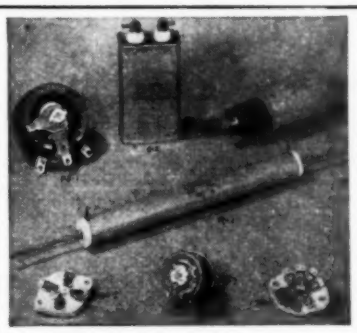
T-18—Sec. #1-415-0-415-130 Mil. Cased Famous Make—N.S. **$2.50**

T-15—Sec. #1-425-0-425-125 Mil. 215V-125 Mil. **$2.95**

T-14—Isolation Type Step Up 110-220-100 Watt. **$2.75**

T-25—5VC 13.5 Amp. 5VC 6.75 A 5VC 6.75 A **$2.95**

T-16—#1-325-0-325-25 Mil. #2-325-0-325-25 Mil. **$3.00**



R-1—10,000 Ohm—120 Watt Bleeder with mounting screw & insulators—3 for **$1.00**
Famous Brand. Doz. for **$3.00**
PR-1—25,000 Ohm. WW Power Rheostat—25 Watt with ¼" Shaft. Each **$0.75**
Famous Brand. 3 for **$2.00**
PR-2—15 Ohm. WW Power Rheostat—110 Watt with ½" Shaft. Each **$1.20**
Famous Brand. 10 for **$10.00**
SO-1—Steatite Octal Socket Glazed. 3 for **$0.50**
Doz. for **$1.80**
C-1—H.V. Cond.—.03—7500 VDC. WKG. **$1.05**
Oil filled ..... 10 for **$10.00**
C-2—Oil filled—6 mfd.—600VDC WKG. **$0.65**
10 for **$6.00**
SO-2—Steatite 4 prong socket. Glazed. 3 for **$0.50**
Doz. **$1.80**

25% deposit required on all C.O.D. orders. Prompt delivery assured. Write Dept RNM. Include postage with order.

GREENWICH SALES CO.
59 Cortland St. Digby 9-3813
NEW YORK CITY 7, N. Y.

L-4—8.5 Henries—125 Mil. 120 Ohms. D.C. res. Navy Cased-Porcelain Terminals **$1.10**

L-9—1 Henry—500 Mils. 30 Ohms. Open case. Grey **$0.50**

L-5—20 Henries—110 Mil. 230 Ohms. D.C. res. Navy Cased-Porcelain Terminals **$1.50**

L-10—1 Henry—140 Mils. 80 Ohms. Cylindrical with clamp..... **$0.35**

L-7—12 Henries—300 Mils. 100 Ohms. Hermetically sealed-Porcelain Terminals **$2.95**

L-11—12 Henries—400 Mils. 85 Ohms. Compact.. **$4.50**

L-6—17 Henries—20 Mils. 300 Ohms. Sealed—with mtg. screws.... **$0.60**

L-12—25 Henries—30 Mil. 850 Ohms. Navy Case. Porcelain Terminals. **$1.05**

L-8—13 Henries Center Tapped. 40 Mils—175 Ohms each. 2 types available **$0.95**

L-14—2 Henries—100 Mil. 0.75 Ohms. Open C. **$0.35**

PRICES SLASHED!! BARGAINS GALORE

neither see, taste, smell, or feel the results of their outlay of cash—so any spade work done in the field of educating the public with regards to radio servicing is work well done.

The flyer might show a service bench with a radio technician at work, or a comic cut depicting the "ills" of a radio receiver might be used. The idea to put across is that when the customer's radio is not working properly *YOU* are the outfit to do the job if the set owner really wants the job done right.

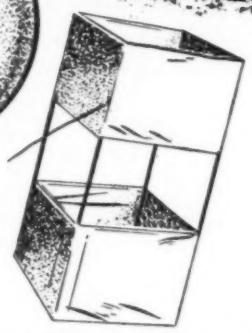
It is not always necessary to have a direct mail agency handle your campaigns for you. If you have the time and facilities for preparing mailing pieces—all well and good. Your own mailing list can be made up from sales slips, the phone book, or from lists rented from non-competitive firms operating in your neighborhood. Religious and cultural centers often have desirable mailing lists which might be for rent and often they have the machines to process such names which could be rented or the job done on a contract basis. This would cut your investment costs by eliminating the necessity for buying specialized equipment.

In case your list has been rented or purchased from a commercial outfit the first step you should take is to break down the list by classifications, if at all possible. Financial, geographical, and classifications by sex should be made so that mailings can go to persons most likely to be interested in the services or merchandise you have to offer. Once a list is so classified, the cards should be marked with colored tabs by groups to facilitate future mailings. Thus, if you as a radio dealer should happen to make a lucky purchase of say, electric razors, you could circularize your male customers without wasting time and money telling the bobby-soxers on your list of the advantages of shaving the "electric way." Similarly if you have a bargain in an inexpensive portable to offer the teen-agers you won't be insulting Mr. Big by telling him that a $19.95 portable is just what he needs for those "jive sessions." See what we mean?

Your mailing list can be a real business-getter for you if you use care in making it up or buying it and then keep it up-to-date. If direct mail pieces are returned to you marked "Moved—Left no address" try to determine the new address—but failing this *remove* the card from the active file. An obsolete mailing list is as useful to you as a business man as a show window without glass. Try to avoid the "this was a good list ten years ago but——."

Don't forget that a good mailing list is good business—because if it is really up-to-date you can make a little extra cash for yourself by renting your list to non-competitive firms for them to use as *their* mailing list. If it is good there will be plenty of demand for it by other firms in your neighborhood. —30—

Try These FOR BETTER PERFORMANCE

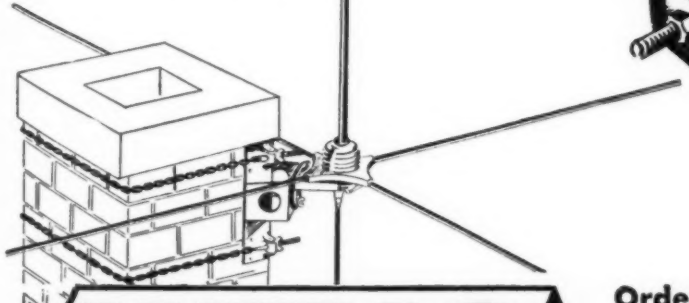


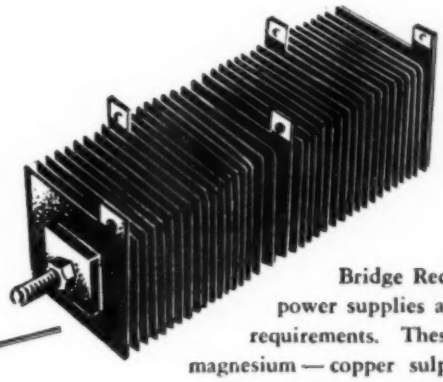
Super DX is possible with a long wire vertical antenna supported by a balloon or kite. Low angle of radiation and easy to load. A complete kit consisting of 2 heavy duty 4 foot balloons, 2 hydrogen generators, a folding aluminum frame box kite with water repellent cloth sails, and 300 feet of stranded antenna wire, packed in a tubular canvas carrying bag, is priced at only $9.95. (Originally cost about $75.00)

The advantages of real FM operation (less noise and QRM) can only be obtained with an FM receiver. You will be amazed at the difference in FM signals if you've heard them only on an AM receiver. The D & L FM Conversion Unit (not a kit) can be quickly wired into any reeciver having an I.F. frequency between 425 and 475 KC. Price only $15.45 complete with instructions.

Standard Make Type 826 — 60 Watt UHF Transmitting Tubes at 49c each! The growing popularity of the higher frequency bands makes this general purpose tube an outstanding value. These 826's are brand new, inspected, and in their original cartons. Shipped only in boxes of 8 tubes at $3.92. (Add 50c for mailing anywhere in U.S.) Ceramic Tube Sockets for 826, 829B — 50c each.

Ground Plane Antenna for 2, 6, or 10 Meters. Clamps to any vertical or horizontal support and is fed with RG8U coaxial cable directly through a connector at the base. Made to withstand extreme weather conditions. Ideal for operation at very high frequencies. Price, complete with ceramic insulated mounting, copper-plated steel elements, heavy duty chain clamp, only $12.50. Specify frequency.





Standard Make Full Wave Bridge Rectifiers for battery chargers, power supplies and other low voltage D.C. requirements. These are the high efficiency magnesium — copper sulphide type rectifiers which are known for their long life at high output. A.C. Input — 32 volts at 9.5 amperes. D.C. Output — 14.8 volts at 7.3 amperes. Price only $4.85 each.

WELLS SALES, INC.

Order Direct From Us or Through Your Local Jobber

All Prices F.O.B. Chicago

320 N. LA SALLE ST. DEPT. R-3, CHICAGO 10, ILL.

RADIOMEN'S HEADQUARTERS ⁂ WORLD WIDE MAIL ORDER SERVICE!!!

RADIO SERVICEMEN!! Buffalo Radio Supply's lower prices mean increased profits for you. Order all of your needs from us and receive in return courteous service and first class merchandise at the lowest prices in the country. Here are a few of our typical bargains.

SELENIUM RECTIFIERS

The new miniature rectifier that more and more manufacturers are using. Order some of each type so you will be ready when these receivers require servicing. Make extra money by installing them in old sets. All types are rated at 130 V. RMS and will withstand an inverse peak of 380 v. The 25 ma unit is for phono osc and bias supplies and converting relays.

25 ma	$0.45	10 for $ 4.00	100 ma	.75	10 for 7.00	200 ma	1.05	10 for 10.00
75 ma	.70	10 for 6.50	150 ma	.80	10 for 7.50			

SPEAKERS

These PM speakers are the finest that are available. All have heavy oversize Alnico V magnets.

3½"	$1.15	6 for $6.60	5"	1.10	10 for 9.50
4"	1.15	6 for 6.60	6"	1.50	6 for 8.70

AUTO RADIO DEALERS! ATTENTION!

A famous nationally advertised brand of auto radio which will fit any car and every pocketbook. Six tube superhet with three gang condenser and 6½" speaker. **Dealer price $32.20 for sample, or $29.97 each, in lots of two or more.**

Here is an item that no serviceman that repairs auto radios can be without. Nationally advertised ATR battery eliminator that supplies perfectly filtered 12 V DC or 6 V DC at 14 amperes from 10 V AC.....**$36.00**

BUFRAD CAR RADIO ANTENNAS

All of our car radio antennas are made of triple plated Admiralty Brass Tubing, complete with low loss shielded antenna leads and have high quality fittings.

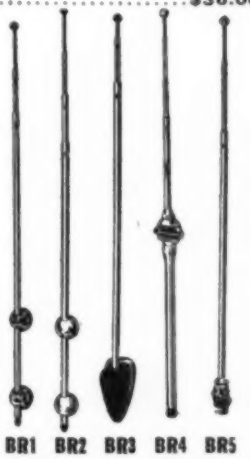
SIDE COWL—BR-1, 3 sections extend to 66". Your price—single units—**$1.50**; in lots of 12—**$1.35** ea.

SKYSCRAPER—BR-2 has 4 heavy duty sections that extend to 98". Your price—single units—**$2.45**; in lots of 12—**$2.25** ea.

TILT ANGLE—BR-3, may be adjusted to all body contours. 3 sections extend to 66". Single unit price—**$1.50**; 12 lot price—**$1.25** ea.

VERSATILE—BR-4, single hole fender or top cowl mounting may be adjusted to conform with all body contours. 4 sections extend to 56". Single unit price—**$2.90**; 12 lot price—**$2.75** ea.

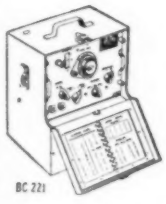
THE MONARCH—BR-5, single hole top cowl mounting, 3 sections extend to 56". Single unit price—**$1.90**; 12 lot price—**$1.75** ea.



BR1 BR2 BR3 BR4 BR5

BENDIX SCR 522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't $2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPUT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles of high altitudes. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit, 4 crystals and the special wide band VHF antenna that was designed for this set. These sets have been removed from unused aircraft and are guaranteed to be in perfect condition. We include free parts and diagrams for the conversion to "continuously variable frequency coverage" in the receiver.

The SCR522 complete with 24 volt dynamotor sells for only **$37.95**. The SCR 522 is also available with a brand new 12 volt dynamotor for only **$42.95**.



BC 221

BC-221 FREQUENCY METERS with calibrating Crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician, service man, amateur, and experimenter at the give away price of only **$36.95**.

100 KC CRYSTAL CALIBRATOR KIT containing everything that is necessary to construct a 100 KC osc that will supply 100 KC marker points to your receiver so that it may be used for frequency determination. The 100 KC crystal is worth far more than the price that we are asking for the complete kit.
Kit 100K—Plate and fil voltage supplied by receiver....$ 9.95
Kit 100KA—Same as the above, including 110 VAC or DC self-contained supply 12.95

DUAL METER—one 50 uA and one 200 uA movement in the same case. This meter is ideally suited for use as a combination modulation percentage and carrier shift indicator. If desired the movements may be removed from the case and used separately. All meters are in perfect operating condition, but a few have cracked glasses. This super value costs only **$1.75**.

CLOSING OUT

THE FOLLOWING DESIRABLE ITEMS AT SACRIFICE PRICES TO MAKE ROOM IN OUR WAREHOUSE FOR INCOMING STOCK

947A ONE KILOWATT HIGH FREQUENCY TRANSMITTER. This relay-controlled transmitter includes a 115 V, 60 cycle power supply, protected by 8 magnetic circuit breakers, that alone is worth more than the price we are asking for the whole rig, even on today's surplus market. On the front panel are six 3½" GE or Weston meters, including 250 MA, 50 MA, 1000 MA, 150 V AC and 1500 V DC at 1000 ohms per volt for screens and plate. The rack-type 21"x15"x36" unit contains six amplifier and rectifier tubes aggregating over $60.00 at WAA current wholesale prices. Western Electric's price to the government was $1500.00. Shipping weight 500 lbs. Your cost at close-out price as is. Formerly $69.95, now only **$39.95**.

5" "SO" RADAR P.P.I. SCOPE, complete with 9 tubes including 807 tube in final power stage that provides deflecting current for magnetic yokes. Selsyn motor and self-contained 110 V power supply designed to run on the AC supply on LST and PT boats. Various ranges from 2 to 80 miles. The most satisfactory scope available for navigational radar or panoramic television applications. Nationally advertised @ $100.00; our price, only **$39.95**.

5 INCH RECEIVER INDICATOR SCOPE. This unit, originally sold by Western Electric for $2500.00, includes a 13 tube receiver with 7 IF stages; 2 tube multivibrator sweep generator; 2 tube sweep amplifier; video amplifier; pedestal impulse and sweep generator, and 115 volt, 60 cycle supply with 2x2 for high voltage. Equipped with more than 15 tubes of the 43 originally used and including a brand new scope tube in original carton. Makes a wonderful laboratory instrument and is better adapted for television than any other war surplus item. Reduced close-out price as is. Formerly $69.95, now **$39.95**.

$9.95 TAKES ALL THREE BIG BARGAINS

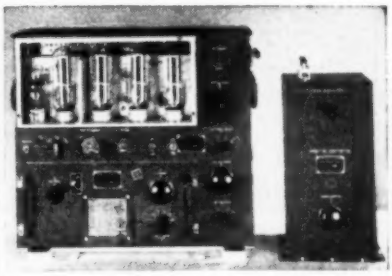
1. AUDIO AMPLIFIER Undreamed of value. Uses 6V6's. Has 4 microphone inputs brought to jacks at rear panel. Various output impedances available at rear panel connections. Steel case with chrome handles, 9" long x 9" high x 6" deep. Tubes included. New in original carton. Shipping weight 20 lbs. **SUPER SPECIAL**—$4.95 while supply lasts.

2. RADIO HEADSETS Latest supersensitive type with rubber earpieces. Every pair guaranteed perfect. **$.59 per pair OR 3 PAIRS FOR $1.00.**

3. HOME WORKSHOP AT BARGAIN PRICE

Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service, supplied with 56" of belting for connecting to any available electric motor or power take-off, such as on a jeep or tractor. Also included in this unbelievable offer are such accessories as a ½" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel with a large supply of buffing compound, and a 4" steel wire scratch brush. Your coat $6.00. Sole export agent. Distributor inquiries invited.

NO C. O. D.'s—ORDER NOW—DON'T DELAY



GENERAL ELECTRIC 150 WATT TRANSMITTER

Cost the Government $1800.00
Cost to you $44.50!!!!

This is the famous transmitter used in U.S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification.) OSCILLATOR: Self-excited, thermo compensated, and band calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½x23x9¼ inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft but are guaranteed to be in perfect condition.

BRAND NEW INVERTERS AND DYNAMOTORS

PE 6A: A 24 to 32 V DC input, to 80 V AC regulated output converter—**$12.95**.
PE 19A: A 24 to 28 V DC input, to 80 V AC at 800 cps output—**$9.95**.
(We include a stepup transformer with each of the above so that 110 VAC is available from either.)
27 V DC input 285 V DC @ 75 MA output—**98c**.
27 V DC input. Output 300 V @ 150 MA, 150 V @ 15 MA and 12 V @ 5 Amp—**$5.95**.
12 V DC input. Output 300 V @ 150 MA, 150 V @ 15 MA and 12 V @ 5 Amp—**$12.00**.
13 or 26 V DC input. Output 800 V DC, 400 V DC @ 135 MA, and 9 V AC—**$15.00**.
(By running on 6 V AC, 60 cycle input, with a small amount of DC for field excitation, the above dynamotor will provide a good source of 12, 24, 400 or 800 V DC.)

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 3N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD

International Short-Wave

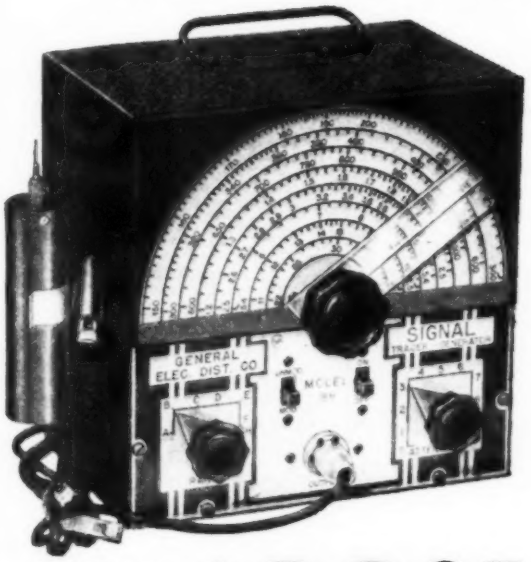
(*Continued from page 67*)

*11.530—Douala, Cameroons.
*11.535—SPD, Warsaw, Poland.
11.595—VRR4, Stony Hill, Jamaica, B.W.I., 500 w.
*11.602—PLN, Bandoeng, Java, "Radio Omroep Bandoeng," 2 kw.
11.615—Teheran, Iran.
11.615—Clandestine, "Espana Independiente."
11.620V—Clandestine, "Espana Independiente."
*11.623—COK, Havana, Cuba, 2 kw.
*11.625—Berlin, Germany.
11.630—Leningrad, U.S.S.R.
11.640—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
*11.640—PZY, Manila, Philippines.
11.645—OTC3, Leopoldville, Belgian Congo, "Radio Nationale Belge," 50 kw.
11.650—XTPA, Canton, China, 1 kw.
11.670—Bogota, Colombia, "Radiodifusora Nacional."
*11.670—OTM3, Leopoldville, Belgian Congo, "Radio Congo Belge," 20 kw.
*11.675—Andorra, Andorra.
*11.675—Moscow.
*11.680—PPQ, Rio de Janeiro, Brazil.
11.680—GRG, London, 50-100 kw.
11.685—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
11.685—XGAF, ..., China, "K'ung Chun Broadcasting Station."
*11.687—Brazzaville, French Equatorial Africa, 500 w.
11.690—Bucharest, Rumania, "Radio Dacia Romana."
11.696—HP5A, Panama City, Panama, "Cadena Panamena de Radiodifusion," 500 w.
*11.698V—XORA, Shanghai, China.
*11.700—CE1170, Santiago, Chile, "Radio Bulnes," 1.5 kw.
11.700—GVW, London, 50-100 kw.
11.700—Paris, "Radiodiffusion Francaise," 100 kw.
*11.705—CBFY, Montreal, Quebec, Canada, 7.5 kw.
*11.705—CKXA, Sackville, Canada, "CBC International Service," 50 kw.
11.705—SBP, Motala (Stockholm), Sweden, 12 kw.
*11.705—JLW3, Tokyo.
11.705—WLWS1/2, Cincinnati, Ohio, U.S.A., 75 kw.
11.705V—XORA, Shanghai, China, "Shanghai Broadcasting Station," 4 kw.
11.710—VLG3, Melbourne, Australia, "Radio Australia," 10 kw.
*11.710—VUD3, Delhi, AIR, 10 kw.
*11.710—Johannesburg, South Africa (Johannesburg III), 5 kw.
11.710—WLWR1, Cincinnati, Ohio, U.S.A., 175 kw.
*11.710—WLWS2, Cincinnati, Ohio, U.S.A., 75 kw.
11.710—Moscow.
11.713V—FHE3, Dakar, Fr. West Africa, "Radio Dakar," 12 kw.
11.715—HEI5, Berne, Switzerland, 25 kw.
*11.715—HSP5, Bangkok, Siam, 10 kw.
*11.715—JLW3, Tokyo.
#11.717—Jerusalem, Palestine.
11.718V—Kiev (?), U.S.S.R.
*11.718—CR7BH, Lourenco Marques, Mozambique, "Radio Mozambique," 300 w.
*11.718—HEU4, Berne, Switzerland, 25 kw.
11.720—OTM4, Leopoldville Belgian Congo, "Radio Congo Belge," 20 kw.
*11.720—Moscow.
*11.720—ORY2, Ruiselede (Brussels), Belgium, "Radio Nationale Belge," 5 kw.
*11.720—Jaffa, Palestine.
11.720—PRL8, Rio de Janeiro, Brazil, "Radio Nacional," 50 kw.
11.720—CHOL, Sackville, Canada, "CBC International Service, 50 kw.
11.720—CRKX, Winnipeg, Manitoba, Canada, 2 kw.
*11.724—HNG, Baghdad, Iraq, 5 kw.
*11.725—XORA, Shanghai, China, 4 kw.
11.725—WRUW, Boston, Mass., N.S.A., 20 kw.
*11.725—JVW3, Tokyo.
*11.725—XGSK, Nanking, China.
11.725—Jaffa, Palestine, "Sharq-al-Adna," 7.5 kw.
*11.725—YVOR, Caracas, Venezuela, "Radiodifusora Nacional," 10 kw.
*11.728—CE1173, Santiago, Chile, "Radio Sociedad Nacional de Mineria," 5 kw.
11.730—OQ2AA, Leopoldville, Belgian Congo, Radio Leo," 50 w.
*11.730—GVV, London, 50-100 kw.
11.730—Paris, "Radiodiffusion Francaise," 100 kw.
*11.730—EQE, Teheran, Iran, "Radio Teheran," 14 kw.
11.730—PHI, Hilversum (Huizen), Holland, "Radio Nederland," 5 kw.
*11.730—KGEI, San Francisco, Calif., U.S.A., 50 kw.
11.730—KGEX, San Francisco, Calif., U.S.A., 100 kw.
11.730—WRUL, Boston, Mass., U.S.A., 50 kw.
11.730—WRUW, Boston, Mass., U.S.A., 20 kw.
*11.735—CR6RC, Luanda, Angola, "Radio Clube de Angola," 150 w.
11.735—Singapore, Malaya, British Far Eastern Broadcasting Service," 75 kw.
#11.735—XGSL, Nanking, China.
11.735—LKQ, Fredrikstad, Norway, 8 kw.
#11.735—CXA7, Montevideo, Uruguay, 5 kw.
*11.735—Belgrade, Yugoslavia, "Radio Belgrade," 10 kw.
11.740—VLB10, Shepparton, Austria, "Radio Australia," 100 kw.
*11.740—KROJ, Los Angeles, Calif., U.S.A.
11.740—COCY, Havana, Cuba, "RHC-Cadena Azul," 1 kw.
*11.740—Athlone, Ireland, "Radio Eirrean," 1.5 kw.
11.740—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
11.740—Moscow.
11.742—CE1174, Santiago, Chile, "Nuevo Mundo," 5 kw.
11.750—GSD, London, 50-100 kw.
11.750—Komsomolsk (Khabarovsk Territory), U.S.S.R., 50 kw.
11.755—HJCAB, Bogota, Colombia, "Radiodifusora Nacional," 2.5 kw.
*11.755—HSPP, Bangkok, Siam.
11.757—Minsk (Byelorussian S.S.R.), U.S.S.R.
*11.760—VLR8, Melbourne, Australia, "A.B.C." 2 kw.
11.760—VLG10, Melbourne, Australia, "Radio Australia," 10 kw.
11.760—VLB3, Melbourne, Australia, "Radio Australia," 100 kw.
11.760—CLB3, Melbourne, Australia, "Radio Australia," 100 kw.
11.760—CKRA, Sackville, Canada, "CBC International Service," 50 kw.
*11.760—OLR4B, Prague, Czechoslovakia, 30 kw.
*11.760—VUD7, Delhi, AIR, 100 kw.
11.760—VUD11, Delhi, AIR, 20 kw.
*11.762—Berlin, Germany.
*11.765—Colombo, Ceylon, "Radia SEAC," 7.5 kw.
*11.765—THA, Algiers, Algeria.
11.766—ZYB8, Sao Paulo, Brazil, "Radio Tupi de Sao Paulo."
11.767—Batavia, Java, "Radio Resmi Indonesia," 3 kw.
*11.767—Fredrikstad, Norway, "Radio Oslo," 8 kw.
*11.770—VLA4, Shepparton, Australia, "Radio Australia," 100 kw.
*11.770—VLB3, Shepparton, Australia, "Radio Australia," 100 kw.
*11.770—Colombo, Ceylon, "Radio SEAC," 100 kw.
11.770—GVU, London, 50-100 kw.
*11.770—Delano, Calif., U.S.A., 200 kw.
11.770—KNBI, Dixon, Calif., U.S.A., 50 kw.
11.770—WGEA, Schnectady, N.Y., U.S.A.
11.770—OTC, Leopoldville, Belgian Congo.
*11.775—HE16, Berne, Switzerland, 25 kw.
*11.775—MTCY, Chungchun, China.
*11.780—OIX3, Lahti (Helsinki), Finland, 15 kw.
11.780—ZL3, Wellington, New Zealand, "National Broadcasting Service," 10 kw.
*11.780—XORA, Shanghai, China.
11.780—HP5G, Panama City, Panama, "Radio Pan-Americana," 1.5 kw.
11.780—Moscow.
11.782—XENN, Mexico City, Mexico, "Radiomundial," 500 w.
11.782—Luxembourg, Luxembourg.
11.783—Saigon, French Indo-China, "Radio Saigon," 12 kw.
11.784—Vienna, Austria, "Radio Wien."
*11.785—Lusaka, Northern Rhodesia.
*11.790—VUD5, Delhi, AIR, 100 kw.
*11.790—KNBA, Dixon, Calif., U.S.A., 50 kw.
11.790—KNBI, Dixon Calif., U.S.A., 50 kw.
*11.790—KNBX, Dixon, Calif., U.S.A., 100 kw.
11.790—WRUA, Boston, Mass., U.A.A., 50 kw.
*11.790—WRUS, Boston, Mass., U.S.A., 50 kw.
11.790—WLWO, Cincinnati, Ohio, U.S.A., 75 kw.
*11.800—YSI, San Salvador, El Salvador, "Radio Intercontinental," 100 w.
11.800—GWH, London, 50 kw.
*11.800—KZFM, Manila, Philippines, "The People's Station."
*11.800—JZJ, Tokyo, 50 kw.
#11.800—XGSM, Nanking, China.
*11.805—OZG, Skamlebak (Copenhagen), Denmark, 6 kw.
*11.810—VLB4, Shepparton, Australia, "Radio Australia," 100 kw.
11.810—Milan, Italy, "Radio Italiana," 10 kw.
11.810—VLG7, Shepparton, Australia, "Radio Australia," 50 kw.
*11.810—HOXB, Panama City, Panama, "Radio Centro-Americana," 7.5 kw.
11.810—KCBF, Delano, Calif., U.S.A.
*11.810—KCBR, Delano, Calif., U.S.A., 200 kw.
11.810—WGEA, Schenectady, N.Y., U.S.A., 50 kw.
*11.815—JVZ, Tokyo, 50 kw.
#11.815—HHK, Leogane, Haiti.
*11.815—HEU5, Berne, Switzerland.
11.820—GSN, London, 50-100 kw.
*11.820—Colombo, Ceylon.
11.820—XEBR, Hermosillo, Mexico, "El Heraldo de Sonora," 100 w.
11.820—Benghazi, Cyrenaica (Africa), "Forces Broadcasting Station."
*11.825—JVZ2, Tokyo, 50 kw.
11.825—Moscow.
*11.825—WCRC, New York, N.Y., U.S.A.
11.830—VLW3, Perth, Western Australia, "A.B.C.," 2 kw.
*11.830—VUD4, Delhi, AIR, 10 kw.
*11.830—WCBN, New York, N.Y., U.S.A., 50 kw.
11.830—WCDA, New York, N.Y., U.S.A., 50 kw.
11.830—WNRX, New York, N.Y., U.S.A., 50 kw.
*11.830—Moscow.
11.835—XGOA, Nanking, China, "Central Broadcasting Station."
11.835—CR7B?, Lourenco Marques, Mozambique, "Radio Club de Mozambique," 300 w to 7.5 kw.

MONEY BACK GUARANTEE We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check the design calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

The Model 88-A *COMBINATION*

SIGNAL GENERATOR AND SIGNAL TRACER



We're prepared for the demand we know will be created by this long overdue combination of the two units which have always been used together. The ultimate in signal tracing procedure is achieved by the Model 88, for the use of this model, enables you to use either the broadcast signal itself or the signal injected by the Signal Generator. This is especially useful of course when servicing "dead" or "intermittent" receivers. The Model 88 you will find is the greatest time-saver ever provided for by combining a full range Signal Generator and Signal Tracer into one unit; the set up time for interconnecting, etc., is entirely eliminated.

Signal Generator Specifications:

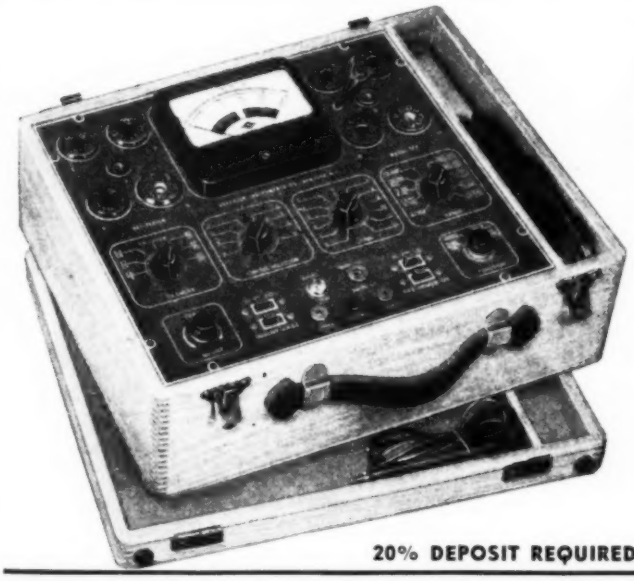
- Frequency Range: 150 Kilocycles to 50 Megacycles.
- The R.F. Signal Frequency is kept completely constant at all output levels. This is accomplished by use of a special grid loaded circuit which provides a constant load on the oscillatory circuit. A grounded plate oscillator is used for additional frequency stability.
- Modulation is accomplished by Grid-blocking action which has proven to be equally effective for alignment of amplitude and frequency modulation as well as for television receivers.
- Positive action attenuator provides effective output control at all times.
- R.F. is obtainable separately or modulated by the Audio Frequency.

Signal Tracer Specifications:

- Uses the new Sylvania IN34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.
- Simple to operate—Clips directly on to receiver chassis, no tuning controls.
- Provision is made for insertion of phones of any impedance, a standard Volt-Ohm Milliammeter or Oscilloscope.

The Model 88 comes complete with all test leads and operating instructions. Only.....

$28.85 NET



The New Model **777**

20,000 OHMS PER VOLT!!

TUBE & SET TESTER

SPECIFICATIONS:

- Tests all tubes including 4, 5, 6, 7, 7L, Octals, Loctals, Television, Magic Eye, Thyratrons, Single Ended, Floating Filament, Mercury Vapor Rectifiers, New Miniatures, etc. Also Pilot Lights.
- Tests by the well-established emission method for tube quality, directly read on the scale of the meter.
- Tests leakages and shorts of any one element against all elements in all tubes.
- Tests both plates in rectifiers.
- Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- New type line voltage adjuster.

V.O.M. SPECIFICATIONS:

- D.C. VOLTS: (At 20,000 Ohms Per Volt) 0 to 7.5/15/75/150/750/1,500 Volts
- A.C. VOLTS: (At 10,000 Ohms Per Volt) 0 to 15/30/150/300/1,500/3,000 Volts
- D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes
- RESISTANCE: 0 to 5,000/50,000/500,000 Ohms 0 to 50 Megohms
- DECIBELS: (Based on zero decibels equals .006 Watts into a 500-Ohm line.) —10 to + 18 db., + 10 to + 38 db., + 30 to + 58 db.

Model 777 operates on 90-120 Volts 60 cycles A.C. Housed in beautiful hand-rubbed cabinet. Complete with test leads, tubes, charts and detailed operating instructions. Size 13" x 12½" x 6".

$59.95 NET PRICE

20% DEPOSIT REQUIRED ON ALL C. O. D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO.

Dept. RN-3, 98 Park Place
New York 7, N. Y.

11.835—CXA19, Montevideo, Uruguay, "El Espectador," 4 kw.
11.836—Algiers, Algeria, "Radio Algerie," 10 kw.
***11.837V**—Tonkin, French Indo-China, "Voice of Vietnam."
***11.840**—VLQ5, Brisbane, Australia, "A.B.C.," 10 kw.
11.840—VLG4, Melbourne, Australia, "Radio Australia," 10 kw.
11.840—VLC7, Shepparton, Australia, "Radio Australia," 50 kw.
11.840—Manila, Philippines; "Voice of the U.S. in Manila."
***11.840**—Rangoon, Burma, "Radio Rangoon," 7.5 kw.
11.840—OLR4A, Prague, Czechoslovakia, 30 kw.
***11.840**—CXA8, Colonia, Uruguay, 3 kw.
***11.842**—LRY, Buenos Aires, Argentina, "Radio Belgrano," 5 kw.
11.845—Paris, "Radiodiffusion Francaise," 25 kw.
***11.845**—JVU2, Tokyo.
***11.850**—VLR9, Melbourne, Australia, "A.B.C.," 2 kw.
***11.850**—Singapore, Malaya.
***11.850**—Tokyo.
***11.850**—Ruiselede (Brussels), Belgium, "Radio Nationale Belge," 5 kw.
11.850—CE1185, Santiago, Chile, "Radio El Mercurio," 3.5 kw.
11.850—VUD3, Delhi, AIR, 5 kw.
***11.850**—Benghazi, Cyrenaica (Africa), "Forces Broadcasting Station."
11.850—VUD11 Delhi, AIR, 20 kw.
***11.850**—LLK, Fredrikstad, Norway, "Radio Oslo," 8 kw.
***11.850**—Saigon, French Indo-China.
11.854—ZPA3, Asuncion, Paraguay, "Radio Teleco," 1 kw.
***11.857**—Tunis, Tunisia, 700 w.
#**11.857**—Rabat, French Morocco.
***11.860**—XMHA, Shanghai, China, 1 kw.
11.860—GSE, London, 50-100 kw.
***11.860**—Medan, Sumatra, "Radio Sumatra," 120 w.
11.865—HER5, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
***11.870**—VLC3, Shepparton, Australia, "Radio Australia," 50 kw.
11.870—Munich, Germany, 80 kw.
11.870—ZPA3, Asuncion, Paraguay.
11.870—VUD9, Delhi, AIR, 7.5 kw.
***11.870**—KWID, San Francisco, Calif., U.S.A., 100 kw.
***11.870**—WNBI, New York, N.Y., U.S.A., 50 kw.
11.870—WNRA, New York, N.Y., U.S.A., 50 kw.
***11.870**—WOOC, New York, N.Y., U.S.A., 50 kw.
***11.870**—WOOW, New York, N.Y., U.S.A., 50 kw.
***11.875**—OLR4C, Prague, Czechoslovakia, 30 kw.
11.875—Moscow.
11.880—LRY1, Buenos Aires, Argentina.
#**11.880**—Horby, Sweden.
#**11.880**—XGSN, Nanking, China.
***11.880**—VLG5, Melbourne, Australia, "Radio Australia," 10 kw.
11.880—VLH4, Melbourne, Australia, "A.B.C.," 10 kw.
***11.880**—VLR3, Melbourne, "A.B.C.," 2 kw.
***11.880**—VLA5, Shepparton, Australia, "Radio Australia," 100 kw.
11.880—XEHH, Mexico City, Mexico, "Sal de Uvas Picot," 250 w.
11.880—Moscow, U.S.S.R.
11.885—Paris, "Radiodiffusion Francaise," 25 kw.
***11.885**—Petropavlovsk, U.S.S.R.
11.885—Komsomolsk, U.S.S.R.
***11.890**—KRHO, Honolulu, Hawaii, 100 kw.
11.890—KWIX, San Francisco, Calif., U.S.A., 50 kw.
11.890—Moscow.
#**11.890**—Manila, Philippines.
***11.893**—WNBI, New York, N.Y., U.S.A., 50 kw.
***11.895**—VPD2, Suva, Fiji Islands, 4 kw.
***11.895**—EQF, Teheran, Iran, "Radio Teheran," 14 kw.
***11.895V**—Hanoi, French Indo-China.
11.898—CE1190, Valparaiso, Chile, "Radio La Cooperativa Vitalicia," 1 kw.
***11.900**—VLG9, Melbourne, Australia, "Radio Australia," 10 kw.
11.900—OO2AB, Elizabethville, Belgian Congo, "Radio Elizabethville," 150 w.
11.900—Hanoi, French Indo-China.
***11.900**—CKEX, Sackville, Canada, "CBC International Service," 50 kw.
***11.900**—OLR4D, Prague, Czechoslovakia, 30 kw.
11.900—CXA10, Montevideo, Uruguay, "Radio Electrica," 20 kw.
11.900—KWID, San Francisco, Calif., U.S.A., 100 kw.
11.900—Moscow.
11.900V—KZFM, Manila, Philippines, "The People's Station."
11.901—HI??, Ciudad Trujillo, Dominican Republic, "La Voz del Yuna," 7.5 kw.
***11.910**—SUW, Cairo, Egypt, 10 kw.
***11.913**—XGOY, Chungking, China.
***11.915**—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
***11.918**—Moscow.
11.920—XGOY, Chungking, China, "Chinese International Broadcasting Station," 35 kw.
***11.923**—LRR, Rosario, Argentina.
11.925V—Soerabaja, Java, "Radio Omroep Soerabaja," 200 w.
11.930—GVX, London, 50-100 w.

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IRC VOLUME CONTROLS

1000 ohm wire wound midgets – manufacturers close out – ¾" shaft ⅜" long – list **$1.25** – over 90% off.

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IRC SEALED Box of 252 **24.95**

SPRAGUE .5 mfd — 300 Volt

That's right – genuine Sprague condensers—manufacturers close out – new fresh stock – size ¾" x 2½" – tinned leads – all guaranteed.

NET EACH **6c** 10 FOR **49c**

OUTPUT TRANSFORMERS

Clean stocks – long leads – mounting feet – made to fit where you need them.

For 6F6-6K6 – to 4 ohm voice coil – size 2" x 1⅝" x 1⅝".
50L6-35L6-25L6 to 4 ohm voice coil 1⅜" x 1⅝ x 1⅜".
Specify quantity of each type you need at **49c**

MULTI-USE WIRE

An old favorite – back again!

Stranded No. 22 tinned wire – glass "ROCKBESTOS" 1000 volt insulation—fireproof aircraft wire – a wartime development – at this low price you can use the best.

100 feet . . . . . **45c** 1000 feet **3.89**

MODEL 451A AC-DC Volt-Ohm – Meter

A dependable instrument of wide utility – sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges: 0-10/50/100/500/1000.
Ohms full scale, 500,000.
Ohms center scale, 7200.

NET complete with batteries **14.90**

MODEL 312 Volt-Ohm – Milliammeter

An economy pocket meter featuring a 2" moving vane meter.
Reads: AC-DC volts, 0-25/50/125/250; Mills AC-DC, 0-50; Ohms, 100,000; mfd. .05-15.
Jacks provide range selection.

NET Complete with cord and plug. **6.75**

JEWELLED PILOT LIGHT ASSEMBLIES

- Miniature bayonet socket
- Mount in 1" hole
- Lamps removable from front of panel
- Available in red, green, or amber – quantities limited – order now.

List Price $1.30
At RSE'S 85% off – you pay **19c**
Back again – by popular demand!

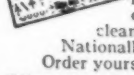
Pep-Up PHILCO CHANGERS

At last! All the parts you need to restore brilliant tone and volume to "sick" changers! You'll need all three items – sell your customer a 100% reconditioning job –

Selenium cell only, no holder	$1.80
Sapphire needle only, no mirror	$1.20
Special original equipment lamp	27c

RECONDITIONING KIT—all three above items – postpaid – special at . . . **3.21**

RADIO RULE



Here is a clear 6" plastic rule – a necessity for radio students, draftsmen, hams, all who desire cleaner, more precise work.
Nationally advertised at $2.00.
Order yours today postpaid only. **35c**

VOLUME CONTROLS

Our own private brand – made by a nationally known manufacturer – you have this same control on your shelf now – the same kind that net for $1.09! Standard noise-free carbon construction – ⅜" bushing – ¼" shaft, 2" long – complete with switch. Ideal all purpose replacement control – individually boxed in our colorful carton carrying the RSE quality seal of approval.

Full range of sizes – with attached switches!

10 M ohms, 15 M ohms, 25 M ohms, 50 M ohms, 100 M ohms, 250 M ohms, 1 Meg. ohms, 2 Meg. ohms **59c each**

500 M ohms **55.00** per 100 assorted

500 M ohms – less switch **39c** ea. 100 for **$35.00**

IRC 10 MEG. ½ WATT.

IRC type BTS 10 Meg. ½ Watt resistors – manufacturers close-out – clean stock – how can you pass them up at **1c ea.**

TRIPLETT PANEL METERS

Panel meters by Triplett! Top quality instruments – new – boxed – five popular types – priced right – your chance to get those meters you've always wanted.

Model 332 – 0-150 A.C. volts – 3" round flush mounting black brass case.
Model 231 – 0-150 A.C. volts – 2" round flush mounting bakelite case.
Model 233 – 0-150 A.C. volts – 2" round metal case – less mounting clamp.
Model 221 – 0-30 D.C. volts – 2" round flush mounting bakelite case.
Model 324 – 0-400 D.C. volts – 3" round projection mounting – bakelite case.
Model 331 – 0-30 A.C. amps. – 3" round flush mounting bakelite case.
Model 322 – 0-150 D.C. volts – 3" round flush mounting black brass case.

Supply limited – order now – list models you desire.

2.95 EACH

PHONO PICKUP CRYSTALS

Standard types – Set Manufacturers close-out – all Guaranteed

Shure P30 – Shure's newest and finest – osmium tipped permanent needle – 1.8 volts output – fits standard mounting holes. List Price $7.50. You pay us **2.69**

SHURE P93 – W57A – pintype terminals – ¾ oz. pressure, 1.6 volt output – 5000 cycle cutoff. List price $5.55 – our Special . . **1.98**

Astatic L-70 – new postwar design – solder terminals-1¼ oz. pressure – 1 volt output – 4000 cycle cutoff. List price $5.55 – we quote you **1.98**

Astatic L75 – another new type – 1¼ oz. pressure –.75 volt output – 6000 cycle cutoff. List price $5.55 – 64% off. **1.98**

ASTATIC L40 – The prewar favorite – used in millions of phonographs – solder terminals – 1¼ oz. pressure –.6 volt output – 4500 cycle cutoff. List price $4.45 – your cost . . **1.98**

RESISTANCE LINE CORDS

Standard 3 terminal 135 ohm AC-DC cords – sturdy construction, flexible – 5½' long complete with plug – for sets having approximately 69-75.2 volts drop in the filaments. Regular list price 1.17

***Only* 33c**

AEROVOX 8/8/8 – 450

Genuine Aerovox triple 8 mfd. – 450 volts – inverted screw mounting – insulated aluminum can 1½" x 4"-6" insulated leads – List price $4.25 – one time only at **89c**

OZ4 TUBES

New, guaranteed, made by the only maker of OZ4's. Buy now! Hit that car radio business hard – $2.20 List – 60% or more off – limited quantity.

Egg crate of 100 **79.00**

In colorful RSE box at 88c ea.

AEROVOX – SOLAR PAPER TUBULARS

Genuine name brand paper bypasses! New, fresh, full capacity standard merchandise – not surplus – all guaranteed! Check the list prices – our low nets – no need to figure the discount – buy 'em now, they've hit bottom!

Mfd.	Volts	List Price	Net Each	Per 100
.01	600	30c	10c	$ 9.15
.02	600	30c	11c	$ 9.95
.05	600	40c	14c	$12.95
.1	600	45c	16c	$14.95

Quantity Prices not assorted.

SEND FOR *FREE* CATALOG

DEMAND THIS SEAL OF QUALITY

ORDER INSTRUCTIONS

Include full remittance with orders of $3.00 or less. Include 25% deposit with all C.O.D. orders of $3.00 or more. All shipments sent express collect if postage is not included. Prices subject to change without notice. BE SURE TO INCLUDE SUFFICIENT POSTAGE. EXCESS WILL BE REFUNDED.

*11.940—CNR2, Rabat, Morocco, "Radio Maroc," 25 kw.
11.948—ZPA5, Encarnacion, Paraguay, "Radio Encarnacion," 2.5 kw.
11.950—Moscow.
*11.955—GVY, London, 50-100 kw.
11.960—Moscow.
*11.960—Tiflis, U.S.S.R.
*11.965—HEK4, Berne, Switzerland, 25 kw.
11.965—Tabriz, Iran, "Radio Tabriz."
*11.970—JIQ2, Tokyo.
11.971—LRS2, Buenos Aires, Argentina, "Radio Splendid."
11.927—Brazzaville, French Equatorial Africa, "Radio Brazzaville, Post Nationale Francaise," 50 kw.
*11.980—Moscow.
*11.985—Andora, Andorra.
11.998—CE1180, Santiago, Chile, "Radio Sociedad Nacional de Agricultura," 1 kw.
*11.998—CS2MO, Lisbon, Portugal, 500 w.
11.998—Damascus, Syria.
*12.00—Brazzaville, French Equatorial Africa, "Radio Club," 500 w.
12.000—Vienna, Austria.
12.000V—Clandestine, "Espana Independiente."
12.002—Malang, Java.
*12.002—YDM3, Djokjakarta (?), Java, "Radio Repoeblik Indonesia."
*12.010—CFCX, Montreal, Canada, 75 w.
12.020—OAX4Q, Lima, Peru, "Radio Victoria," 1 kw.
12.020—Moscow.
*12.020V—Tonkin, French Indo-China, "Voice of Vietnam."
12.024—CR6R:, Benguela Angola, "Radio Clube de Bengueala.
12.040—GRV, London, 50-100 kw.
12.050—VRR5, Stony Hill, Jamaica, B.W.I., 500W.
12.060—Moscow.
*12.074V—Hanoi, French Indo-China.
*12.080—PST, Rio de Janeiro, Brazil, 12 kw.
*12.080—Moscow.
12.095—GRF, London, 50-100 kw.
12.110—ZKG4, Pitcairn Island.
*12.110—HI3X, Ciudad Trujillo, Dominican Republic.
*12.112—Moscow.
*12.115—ZNR, Aden, Arabia, 500 w.
*12.118—THA1, Algiers, Algeria, "Radio Algerie," 12 kw.
*12.120—Tabriz, Iran, "Radio Tabriz."
*12.127—Tananarive, Madagascar, "Radio Tananarive," 5 kw.
12.130—TPZ, Algiers, Algeria.
*12.150—Hanoi, French Indo-China.
*12.170—Moscow.
*12.180—Tabriz, Iran, "Radio Tabriz."
*12.182—OAX5C, Ica, Peru, 150 w.
*12.183—Soerabaja, Java, 200 w.
12.195—SVP, Athens, Greece.
12.212—Vienna, Austria.
*12.217—XMTA, Shanghai, China.
12.219—XMPA, Nanking, China, "Chinese Army Radio Service."
*12.230—Moscow.
12.235—TFJ, Reykjavik, Iceland, 7 kw.
*12.050—CRY4, Macao, Portuguese China.
12.255—WXFG, Adak, Aleutian Islands, U.S.A.
*12.260—Moscow.
12.270—CE1227, Puntarenas, Chile, "Radio Ejercito."
*12.273—Bandoeng, Java.
12.364—....., French Indo-China, "Voice of South Vietnam."
12.395—Baku, (Azerbaijan S.S.R.), U.S.S.R.
*12.400—CS2WI, Parede, Portugal.
12.420—Bukit Tinggi, Sumatra, "Radio Repoeblik Indonesia."
12.450—ZKG, Pitcairn Island.
12.455—HCJB, Quito, Ecuador, "La Voz de los Andes," 10 kw.
12.455—GKU3, Royal Observatory (Greenwich).
*12.495—Baku, U.S.S.R.
12.500—ISP, Rome, Italy.
*12.710—FIA, Douala, Cameroons.
12.725V—Tonkin, French Indo-China, "The Voice of Vietnam."
12.750—CS2MP, Lisbon, Portugal, "Emissora Nacional," 500 w.
*12.830—CNR1, Rabat, Morocco, "Radio Maroc," 12 kw.
12.862.5—Ronne Antarctic Expedition.
*12.950—VP4RD, Port-of-Spain, Trinidad.
*12.965—HBJ2, Geneva, Switzerland, 40 kw.
*13.020—Moscow.
*13.050—WNRI, New York, N.Y., U.S.A., 50 kw.
13.050V—Clandestine, "Espana Independiente."
*13.155—WLXJ, Shanghai, China.
*13.180—YAK, Kabul, Afghanistan.
*13.190—Khabarovsk, U.S.S.R.
*13.205—HBJ, Geneva, Switzerland, 40 kw.
13.250—ICA, Algiers., Algeria.
13.258—VPO2), Barbados, B.W.I.
*13.295—Omdurman, Anglo-Egyptian Sudan, 250 w.
13.335—Omdurman, Anglo-Egyptian Sudan, 250 w.
13.400—Moscow.
*13.450—Moscow.
*13.450V—Clandestine, "Voice of Slovak Republic."
*13.495—HODD, Panama City, Panama.
13.601—PMS4, Soerabaja, Java, "Radio Resmi Soerabaja," 250 w.
*13.610—Moscow.
13.625V—Clandestine, "Espana Independiente."
*13.635—SPW, Warsaw, Poland.
13.640—SVQ, Athens, Greece, 7 kw.
13.650V—Clandestine, "Espana Independiente."
*13.655—Moscow.
13.670—SVR, Athens, Greece, 7 kw.
13.712—FFE, Paris, 15 kw.
13.720—KLL, Bolinas, Calif., U.S.A.
13.725—SVS, Athens, Greeve, 7 kw.
13.771—FSE, Paris.
13.825—SUZ, Cairo, Egypt, 10 kw.
13.870—Tiflis, U.S.S.R.
13.877—SUP3, Egypt, 10 kw.
13.950—Clandestine, "Espana Independiente."
*13.965—CNR4, Rabat, Morocco, "Radio Maroc," 2 kw.
*13.980—LCO, Oslo, Norway, 1 kw.
14.273—Nova Lisboa, Angola.
14.282—EA9AA, Tangier, Tangier Zone, "Radio Africa."
14.420—SVR, Athens, Greece.
14.450—DAKV, Berlin, Germany
*14.461—HBZ3, Geneva, Switzerland, 40 kw.
14.500—XEXA, Mexico City, Mexico.
*14.500—CRY6, Macao, Portuguese China.
14.525—XDA, Chapultepec, Mexico, "Radio Mex," 20 kw.
*14.537—HBZ2, Geneva, Switzerland, 20 kw.
14.544—HI2T, Ciudad Trujillo, Dominican Republic, "La Voz del Yuna."
14.546—YHP, Soerakarta, Java, "Radio Nocsantara."
*14.555—HVJ, Vatican City, Vatican, "Radio Vaticano," 15 kw.
*14.630—Ponta Delgada, Azores, "Emissora Nacional," 1 kw.
*14.630—PLJ, Bandoeng, Java.
14.687—PSP, Rio de Janeiro, Brazil, 12 kw.
#14.717—Geneva, Switzerland.
14.736—IQD, Rome, Italy.
*14.774—Dakar, French West Africa, "Radio Dakar."
14.828—OQ2AB, Elizabethville, Belgian Congo, "Radio Elizabethville," 100 kw.
14.830—Moscow.
14.845—OCD2, Lima, Peru.
14.850—LPA8, Rio Grande, Argentina.
14.851—Ushuaia, Tierra del Fuego, Argentina, "Governacion Maritima."
*14.935—PSE, Rio de Janeiro, Brazil, 12 kw.
*14.950—PZ?, Paramaribo, Surinam, "Ayros, Paramaribo."
15.000—WWV, Washington, D.C., U.S.A.
15.015—VP52, Malta.
15.040—Moscow.
*15.040—Macao, Portuguese China.
15.050—ZLR5, Wellington, New Zealand.
15.053—ETA, Addis Ababa, Ethiopia, "Radio Addis Ababa," 7 kw.
15.070—GWC, London, 50-100 kw.
*15.073—ETA, Addis Ababa, Ethiopia, 7 kw.
15.085—ZJA6, Georgetown, British Guinea, 2 kw.
15.087—Moscow.
15.090—CBLX, Montreal, Canada, "Radio Canada," 7.5 kw.
15.095—HVJ, Vatican City, Vatican, "Radio Vaticano," 15 kw.
15.100—EPB, Teheran, Iran, "Radio Teheran," 14 kw.
*15.100—Paris, France.
*15.100—HCJB, Quito, Ecuador, 1 kw.
*15.100—HOXA, Panama City, Panama, "Radio Centro-Americana," 7.5 kw.
*15.103—JLG4, Tokyo.
*15.103—Addis Ababa, Ethiopia.
#15.105—Rabat, French Morocco.
15.105—DTSP, Germany.
#15.105—XGSO, Nanking, China.
15.110—GWG, London, 50-100 kw.
15.110—Petropavlovsk, U.S.S.R.
#15.115—CE1511, Santiago, Chile, "Radio Sociedad Nacional de Mineria," 5 kw.
15.115—HCJB, Quito, Ecuador, "The Voice of the Andes," 1 kw.
*15.115—JLR2, Tokyo.
15.120—Colombo, Ceylon, "Radio SEAC," 7.5 kw. and 100 kw.
*15.120—Athlone, Ireland, "Radio Eirrean," 1.5 kw.
*15.120—Warsaw, Poland.
*15.120—CS2MS, Lisbon, Portugal, "Emissora Nacional," 10 kw.
*15.120—HED7, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
15.120—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
15.122—Milan, Italy, "Radio Roma," 50 kw.
*15.130—VUD3, Delhi, AIR, 5 kw.
15.130—VUD11, Delhi, AIR, 20 kw.
*15.130—Delano, Calif., U.S.A., 50 kw.
15.130—KCBR, Delano, Calif., U.S.A., 100 kw.
*15.120—KGEI, San Francisco, Calif., U.S.A., 50 kw.
*15.130—KGEX, San Francisco, Calif., U.S.A., 100 kw.
15.130—WOOC, New York, N.Y., U.S.A., 50 kw.
*15.130—WRUA, Boston, Mass., U.S.A., 50 kw.
*15.130—WRUS, Boston, Mass., U.S.A., 50 kw.
*15.130—WLWR, Cincinnati, Ohio, U.S.A., 175 kw.
*15.130—WLWS, Cincinnati, Ohio, U.S.A., 75 kw.
*15.130—XRRA, Peiping, China.
#15.135—XGSP, Nanking, China.
15.140—GSF, London, 50-100 kw.
15.140—JLW6, Tokyo.
15.140V—YDC, Batavia, Java, "Radio Batavia," 3 kw.
15.144—Moscow.
*15.145—OTM5, Leopoldville, Belgian Congo, "Radio Congo Belge," 20 kw.
*15.145—HHN, Baghdad, Iraq, 5 kw.
#15.150—CE1515, Santiago, Chile, 5 kw.
15.150—Munich, Germany, 80 kw.
15.150—KCBA, Delano, Calif., U.S.A., 50 kw.
*15.150—KCBF, Delano, Calif., U.S.A., 50 kw.
*15.150—KCBR, Delano, Calif., U.S.A., 200 kw.
*15.150—KNBX, Dixon, Calif., U.S.A., 100 kw.
15.160—WRCA, New York, N.Y., U.S.A., 50 kw.
*15.152—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
*15.155—ZYB9, Sao Paulo, Brazil, "Radiodifusora Sao Paulo," 5 kw.
15.155—SBT, Motala (Stockholm), Sweden, 12 kw.

"Communications"

RADAR • AMATEUR
AIRCRAFT • INDUSTRIAL

MICROWAVE PLUMBING

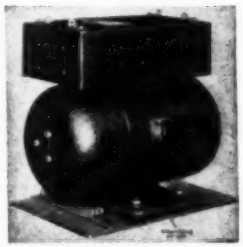
10 CENTIMETER

Sand Load (Dummy Antenna) wave guide section with cooling fins, app. 23" high $26.00
Rigid Coax Directional Coupler CU-90/UP 20 DB drop has short right angle, about 8" 5.50
Waveguide to flexible coax coupler (RG 18 U), with flange. Gold plated. App. 10" high (as shown) 17.50
Rigid coax slotted section CU-60/AP..... 5.00
Stub-supported rigid coax, gold plated, 5" lengths. Per 5' length 5.00
10 Cm. McNally cavity. Silver Plated. Type SG. Each 3.00
Crystal Mixer, "S" Band. Complete with Type "N" fitting and 1N22 crystal..... 3.85
10 Cm waveguide, 5'9" choke to cover. Per section 12.00
Per set of 4 sections..... 45.00
⅞" rotary coax, rotary joint..... 8.00
Magnetron coupling to ⅞" rigid coax..... 4.00
⅞" rigid coax, Rt. angle bend, 15" long, overall 2.00

3 CENTIMETER

Wave Guide Sections 2.5' long, silver plated with choke flange..... $ 5.75
Wave Guide 90 deg. bend E Plane 18" long.. 4.00
Wave Guide 90 deg. bend E plane with 20DB directional coupler 4.75
Wave Guide 18" long "S" curve..... 2.00
Rotary wave guide in/out choke to choke joint 6.00
3 Cm wavemeter Maquire 1539TFX..... 15.00
3 Cm waveguide, 1⅛x½". 15 ft. lengths available. Per ft. 1.50
Waveguide 2.5' long, silver plate, 180 deg. bend choke to cover..... 5.95
Duplexer Section using 1B24..... 10.00
Thermistor mount in waveguide with tunable terminations 8.00
Tuner/attenuator, WE guide, gold plated... 3.75
TR/ATR section with wavemeter iris flange 4.00
CG/AI'S-3, waveguide section, 10" choke to cover 1.75
Right angle elbow, 5½" choke to cover, 2½" radius. E plane 4.50
H plane 5.50
Twist, 90 deg. 6" choke to cover..... 5.00

DYNAMOTORS



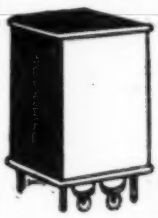
8GN Input: 28 VDC. Output: 250 VD @ C @ 60 Ma. Westinghouse..... $ 1.95
PC77. Input: 12 VDC. Output 275 VDC 110 Ma. 500 VDC @ 50 Ma. 3.25
DAG 33A: Input: 18 VDC @ 3.2 A. Output: 450 VDC @ 60 Ma. 2.45
DM 33 A. Input: 28 VDC @ 7 A. Output: 540 VDC @ 250 Ma. Power supply for modulator for SCR 274 N 3.95
Dyn. Model 23350. Input 27 VDC @ 1.75 A. Output: 245 VDC @ 75 Ma. 1.75
DM-21: In 14 VDC 3.3 A Out 235 VDC 90 Ma. with filter 2.89
PE 55. Input: 12 VDC @ 25 amp. Output: 500 VDC @ 400 ma. (slightly used, but in excellent condition) 4.95
MP 10-G. Power supply using 2 dynamotors. Input: 24-28 VDC. Output: 1000 VDC @ 400 ma. 230 volts dc @ 100 ma. New, complete with enclosed relays, filters, etc. 20.00
MK II dynamotor power supply. Input: 12 VDC @ 9.4 amp. Output: 275 VDC @ 110 ma. 500 VDC @ 50 ma. New, with connecting cable and plugs..... 4.75

INVERTERS

PE 206-A. Input: 28 VDC @ 38 amp. Output: 80 volts @ 500 volt-amps, 800 cycles. Leland. New, complete with enclosed relay, filter, instruction book 12.50
PE 218. Input: 25-28 VDC @ 92 amps. Output: 115 volts @ 1500 volt-amps, 380-500 cycles 15.00

PE 73 CM. Power supply for BC 375. Input: 28 VDC. Output: 1000 VDC @ 350 Ma. Starting relay, filter etc. New. $4.95
BD 77KM. Power supply for BC 191. Input: 14 VDC. Output 1000 VDC @ 350 Ma. New, with spare fuse links, etc. $5.95
PE 101C. Input 13/26 VDC @ 12.6/6.3 A. Output: 400 VDC @ 135 Ma., 800 VDC @ 20 Ma., 9 VAC @ 1.21 A)..$3.49

TRANSFORMERS



POWER TRANSFORMERS

Pri.: 117 V., 60 cycles. Sec. 330-0-330 v. @ 85 ma. 5 v. @ 2 amp. 6.3 v. @ .3 amp., 6.3 v. @ 7.5 amp. Size: 6x4¼x3⅝". Weight: 9¾ lbs. $1.95
Power Pair—Transformer 470 V CT @ 60 ma.; 6.3 V windings @ 1.65A and 5 V @ 2 A—Primary: 115 V 50 to 1200 Cy. PLUS a 6 Hy. 50 ma. choke. Both $1.75

FILAMENT TRANSFORMERS

All Primaries 117V, 60 Cy.
No. 5120: 5 V @ 3 A CT, 5 V @ 3 A CT, 5 V @ 6 A CT $2.25
No. 5100: 6.3 V CT @ 1.2 A. 5000 volt test ..$1.35
No. 5085: 6.3 V NCT @ .6 A, 6.3 V NCT @ 1.5 A ..... $ 1.40
No. UX6809: 5 V @ 5.5 A, 5 V @ 3.5 A 20,000 V test 24.50

CHOKES

6 Hy @ 150 Ma..... $1.50
6 Hy @ 300 Ma..... 3.25
1 Hy @ 800 Ma., 7.5 Ohms..... 8.95
Dual Choke, 2-2 Hy @ 100 Ma..... .90
Dual Choke, 7 Hy @ 75 Ma., 11 Hy @ 60 Ma. 1.50
8.5 Hy @ 125 Ma..... 1.50
25 Hy @ 65 Ma..... 1.10

CATHODE RAY TUBES

5BP1—$1.20 Each

3BP1	$1.25	5BP4	$1.60
3FP7	1.20	5HP1	1.20
5FP7	1.75	5JP2	4.00

Rectifier Tubes

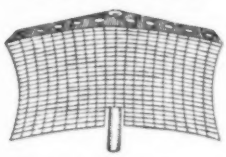
872A	$1.00	705A	$1.25

12 AND 24 VOLT FILAMENT TRANSFORMERS

(All Primaries 110 V, 60 Cycles)

#517: Output: 12 v @ 10 amp, or 24 volts @ 5 amps..... $2.75
#2Z17: Output: 24 volts @ 3 amp. Size: 3" x 3½" x 3"..... 1.50

MICRO-WAVE ANTENNAS



AN/TPS -3. Parabolic reflector, approx. 10' diam. Extremely light weight construction. New, in portable carrying case $35.00
Relay System Parabolic reflectors approx. range: 2000 to 6000 Mc. Dimensions: 4.5'x3'. New 85.00
TDY "Jam" Radar rotating antenna. 10cm. 30 deg. beam. 115V AC drive New 100.00
SO Surface Search Radar rotating antenna, 10 cm., 24" dish, complete with drive and selsyn motors, New 75.00
Used 45.00
3 CM ANTENNA WITH DISH. 14½" Cutler Feed horizontal and vertical scan with 28V DC drive motor and drive mechanism. Complete. New 65.00
AS 125/APR Cone antenna, stub-supported, with type "N" connector 4.50
10 CM horn, rectangular-to square-to circular RF assembly ending in horn, radiating circularly polarized beam. Wave-guide input, complete with flange..... 35.00

ARC-5 ACCESSORIES

Broadcast band R.F. coil assembly, plug-in case $1.00
Single, double mounting racks for revrs. $1.00, 1.50
Shock mounts for racks..... .50
Dual receiver control boxes..... 1.00

3-4 mc. conversion kit for ARC-5 Xmtrs. Consists of 1—#6029 Oscillator coil (3-4 mc) and 1—#7247 PA coil (3-4mc). Per set $1.50

ARC #6030 M.O. coil, 4-5.3 mc. For ARC5 Xmtrs..... $1.00
ARC #6032 M.O. coil, 7-9.1 mc... 1.00
ARC #6558, Variable capacitor, receiving type, 3 sections, 62 mmf/section, .03" spacing, 8 rotors. Worm drive ratio 33:1 ..... 1.75
ARC #4490: Variable Xmtg. capacitor, 23-145 mmf, .05" spacing, 11 rotors. Each 1.00
ARC #5032: Variable Xmtg. capacitor, 30-117 mmf, .06" spacing, 16 rotors. Worm drive: 96:1.... 1.00

MICROWAVE TUBES

(Magnetrons)

2J32 (10 CM)...$15.00
Magnet for 2J32.. 8.00
2J38 with magnet 25.00
2J55 with magnet 25.00
3J31 (1 CM)..... 17.50
Magnet for 3J31 8.00
2J21 ..... 15.00
2J21A 15.00
2J22 ... 15.00
2J26 ... 15.00
2J31 ... 15.00
W.E. 700A (L band) .. 45.00
W.E. 720BY (S band) 1000 KW .. 25.00

Klystron, 2K25-723, AB 3.50

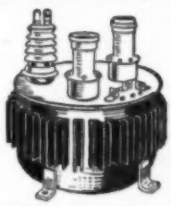
TUNING UNITS

From BC 191 & BC 375 TU 6B 3000 kc to 4500 kc, TU 9B-7700 to 10,000 kc, TU 10B-10,000 to 12,500 kc, TU 22 B 350 to 650 kc. Will supply closest unit to specified Frequency at time of shipment. Each $2.25

SPEAKER-DRIVER UNITS

Frequency response up to 18,000 cps. Heavy duty unit, originally designed for shipboard use. Uses 2" voice coil with 1½" cone. 8 ohm impedance. Makes an excellent tweeter for high fidelity reproduction. New, with spare cone....$9.95

PULSE TRANSFORMERS



All Standard Name Items GE No. K2731

Repetition Rate: 635 PPS. Pri. Imp: 50 Ohms. Sec. Imp: 850 Ohms. Pulse Width: 1 Microsec. Pri. Input: 9.5 KV PK. Sec. Output: 28 KV PK. Peak Output: 800KW Bifilar. 2.75 Amp. $19.50
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UX 4298E Raytheon Pri. 4 KV, 1 microsecond sec. 16 KV, 16 amps. Fil. pri. 115v 400 cycle. Raytheon 15.00
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Pulse Input, line to Magnetron. G.E. K2748A 12.00
Utah Pulse or Blocking Oscillator Transformer Freq. limits 790-810 cy—3 windings turns ratio 1:1:1. Dimensions 1 13/16x1¼x1 19/32". 2.00

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10 Cm. RF Package. Consists of: 80 Xmtr. - receiver using 2J27 magnetron oscillator, 250 KW peak input. 707-B receiver-mixer ...$150.00
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Receiver rectifier power unit for above $25.00
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Used 45.00

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Power unit type 15. Input: 12 vdc @ 30 amps. Output: 300 vdc @ 260 ma, 150 vdc @ 10 ma, 14.5 vdc @ 5 amp. New, complete with starting relays, filters, wooden carrying chest $7.89

250 WATT OUTPUT TRANSFORMER

W. E. #KS 9496, HI-FI output. 9,000 ohm push-pull plates to 9 ohm voice coil. Freq. Response: -3 db @ 50 cps, -1.25 db @ 100 cps, 0 db @ 1,000 cps, .3 db @ 10,000 cps, 3db @ 50,000 cps $3.95

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UG 21/U, Type "N" Male.$0.85
UG 86/U, Gold Plated .... .95

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RG0U51 ohm Silver Coated .....per ft. $0.07½
RG8U 52 ohm...per ft. .04½
COAX Connectors, Amphenol Loss type 831R, 831AP .....ea. $0.27

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P-29 Headsets, 10,000 ohm impedance. Similar to Trimm #7045. With 8' cord PL 55 plug...$2.25
Dynamic mike and headset combination. A high quality, efficient unit, used in B-19 tank Xmtrs. Mike & phones complete, new. As shown $2.75
R-15 headsets: 8000 ohms impedance, rubber cushions. Comes with 8" cord & plug PL 55. New...$1.95
HS 30 headset. Insert type headset, cuts out background noise, and low impedance (500 ohms) assures efficiency and high fidelity. Price $0.85
Xmtr to match 8000 ohms output. $0.35

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*15.160—VLG7, Melbourne, Australia, "Radio Australia," 10 kw.
15.160—VLB11, Shepparton, Australia, "Radio Australia," 100 kw.
*15.160—OLR5C, Prague, Czechoslovakia, 30 kw.
*15.160—VPD2, Suva, Fiji Islands, 4 kw.
15.160—VUD7, Delhi, India, AIR, 100 kw.
*15.160—VUD10, Delhi, AIR, 20 kw.
15.160—JVC, Nazaki, Japan, 40 kw.
*15.160—JZK, Tokyo.
15.160—XEWW, Mexico City, Mexico, 10 kw.
*15.165—OTC4, Leopoldville, Belgian Congo, "Radiodiffusion National Belge," 50 kw.
15.165—PRE9, Fortaleza, Brazil, "Ceara Radio Club," 5 kw.
*15.165—Algiers, Algeria, listed here by NNRC.
*15.165—XGOY, Chungking, China, "Chinese International Broadcasting Station," 35 kw.
15.165—OZH, Skamlebak (Copenhagen), Denmark, 6 kw.
15.170—LKV, Oslo, Norway, 5 kw.
15.170—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
*15.170—XGOY, Chungking, China.
*15.170—OAX4R, Lima, Peru, "Radio Nacional de Peru," 10 kw.
15.170—Moscow.
15.175—LLM, Fredrikstad, Norway, "Radio Oslo," 6 kw.
15.180—GSO, London, 50-100 kw.
#15.190—PRI3, Belo Horizonte, Brazil, "Radio Inconfidencia," 12 kw.
15.190—CKCX, Sackville, Canada, "CBC International Service," 50 kw.
*15.190—ZBW4, Hong Kong, China, 2.5 kw.
15.190—OIX4, Pori (Helsinki), Finland, 15 kw.
15.190—VUD5, Delhi, AIR, 100 kw.
*15.192—CBFZ, Montreal, Canada, 7.5 kw.
15.195—TAQ, Ankara, Turkey, "Radio Ankara," 20 kw.
*15.200—VLR10, Melbourne, Australia, "A.B.C.," 2 kw.
15.200—VLA6, Shepparton, Australia, "Radio Australia," 100 kw.
*15.200—VLB6, Shepparton, Australia, "Radio Australia," 100 kw.
15.200—VLC, Shepparton, Australia, "Radio Australia," 50 kw.
*15.200—WOOC, New York, N.Y., U.S.A., 50 kw.
*15.200—WLWL, Cincinnati, Ohio, U.S.A., 75 kw.
15.200—WRUA, Boston, Mass., U.S.A., 50 kw.
*15.200—WLWS, Cincinnati, Ohio, U.S.A., 75 kw.
*15.210—VLC11, Shepparton, Australia, "Radio Australia," 50 kw.
15.210—OQ2AA, Leopoldville, Belgian Congo, "Radio Leo," 50 w.
*15.210—VUD3, Delhi, AIR, 5 kw.
*15.210—KGEX, San Francisco, Calif., U.S.A., 100 kw.
15.210—WBOS, Boston, Mass., U.S.A., 50 kw.
15.210—PLF1, Bandoeng, Java.
*15.220—CHTA, Sackville, Canada, "CBC International Service," 50 kw.
15.220—PCJ, Hilversum (Huizen), Holland (Netherlands), "Radio Nederland," 30 kw.
*15.220—XGOY, Chungking, China.
15.222V—Clandestine, "Espana Independiente."
#15.225—XGSQ, Nanking, China.
15.225V—JVW, Kawachi, Japan, "N.H.K.," 20 kw.
*15.228V—Komsomolsk, U.S.S.R., 50 kw.
15.230—VLH5, Melbourne, Australia, "A.B.C.," 10 kw.
15.230—VLG6, Melbourne, Australia, "Radio Australia," 10 kw.
15.230—OLR5A, Prague, Czechoslovakia, 30 kw.
15.230—CR7BD, Lourenco Marques, Mozambique, "Radio Clube de Mozambique," 300 w.
*15.230—WLWL, Cincinnati, Ohio, U.S.A., 75 kw.
15.230—Komsomolsk, U.S.S.R.
15.230—Moscow.
15.230—Colombo, Ceylon, "Radio SEAC," 6 kw.
15.235—JVW4, Tokyo.
#15.235—XGSR, Nanking, China.
15.240—VLG6, Melbourne, Australia, "Radio Australia," 10 kw.
*15.240—KCBA, Delano, Calif., U.S.A., 50 kw.
*15.240—KNBI, Dixon, Calif., U.S.A., 50 kw.
*15.240V—Belgrade, Yugoslavia, "Radio Belgrade," 10 kw.
15.241—Paris, "Radiodiffusion Francaise," 100 kw.
15.250—KRHO, Honolulu, Hawaii, 100 kw.
*15.250—KNBI, Dixon, Calif., U.S.A., 50 kw.
15.250—KNBX, Dixon, Calif., U.S.A., 100 kw.
*15.250—WBOS, Boston, Mass., U.S.A., 50 kw.
15.250—WLWK, Cincinnati, Ohio, U.S.A., 50 kw.
15.250—WLWR, Cincinnati, Ohio, U.S.A., 175 kw.
#15.250—Manila, Philippines.
15.260—GSI, London, 50-100 kw.
*15.270—KCBF, Delano, Calif., U.S.A., 50 kw.
*15.270—KCBR, Delano, Calif., U.S.A., 200 kw.
*15.270—WBOS, Boston, Mass., U.S.A., 50 kw.
15.270—WCRC, New York, N.Y., U.S.A., 50 kw.
15.270—WCBN, New York, N.Y., U.S.A., 50 kw.
15.270—Sverdlovsk, U.S.S.R.
*15.275V—Singapore, Malaya, "British Far Eastern Service," 7.5 kw.
15.276—Moscow.
15.280—ZL4, Wellington, New Zealand, 10 kw.
15.280—WNRE, New York, N.Y., U.S.A., 50 kw.
*15.280—Moscow.
15.280—Brussels, Belgium.
*15.280—XUPA (now XURA), Tai-Pei, Formosa.
*15.290—LRU, Buenos Aires, Argentina, 5 kw.
*15.290—VUD3, Delhi, AIR, 5 kw.
15.290—VUD11, Delhi, AIR, 20 kw.
*15.290—KWID, San Francisco, Calif., U.S.A., 100 kw.
15.290—WRUL, Boston, Mass., U.S.A., 50 kw.
*15.295—Belgrade, Yugoslavia, "Radio Belgrade," 10 kw.
15.300—GWR, London, 50-100 kw.
*15.300—Rome, Italy.
*15.300—Paris, France.
#15.300—Horby, Sweden.
#15.300—CXA18, Montevideo, Uruguay.
#15.300—HHK, Leogane, Haiti.
15.300—Singapore, Malaya, "British Far Eastern Broadcasting Service," 7.5 kw.
15.305—HER6, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
15.309—Novosibirsk, U.S.S.R.
15.310—GSP, London, 50-100 kw.
*15.310—YDB, Soerabaja, Java.
*15.310—KZRH, Manila, Philippines.
15.314V—Moscow.
*15.315—YVPX, Caracas, Venezuela, "Radiodifusora Nacional," 1 kw.
*15.315—HEU6, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
15.320—VLA5, Shepparton, Australia, "Radio Australia," 100 kw.
15.320—VLC4, Shepparton, Australia, "Radio Australia," 50 kw.
15.320—CKCS, Sackville, Canada, "CBC International Service," 50 kw.
*15.320—OLR5B, Prague, Czechoslovakia, 30 kw.
15.320—DAKV, Berlin, Germany.
15.320—OZH2, Skamlebak (Copenhagen), Denmark, 6 kw.
*15.320—HEI7, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
15.320V—Moscow.
15.325—OQ2RC, Leopoldville, Belgian Congo, "Radio Congolia," 250 w.
15.325—JVW3, Kawachi, Japan, "N.H.K.," 20 kw.
*15.325—JLP2, Tokyo.
15.325—HEU7, Berne, Switzerland.
*15.326—Lourenco Marques, Mozambique, "Radio Mozambique."
15.330—KCBA, Delano, Calif., U.S.A., 50 kw.
*15.330—KCBR, Delano, Calif., U.S.A., 200 kw.
15.330—KNBX, Dixon, Calif., U.S.A., 100 kw.
15.330—WGEO, Schenectady, N.Y., U.S.A., 100 kw.
*15.330—MTCY, Changchun, China.
*15.335—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
*15.340—KNBX, Dixon, Calif., U.S.A., 100 kw.

15.340—Moscow.
*15.345—FEH2, Dakar, French West Africa, "Radio Dakar," 12 kw.
15.350—XGOA, Nanking, China, "The Voice of China," 10 kw.
15.350—Paris, "Radiodiffusion Francaise, 25 kw.
*15.350—VUDS, Delhi, AIR, 7.5 kw.
*15.350—WRUA, Boston, Mass., U.S.A., 50 kw.
*15.350—WRUS, Boston, Mass., U.S.A., 50 kw.
15.350—WLWO, Cincinnati, Ohio, U.S.A., 75 kw.
15.352—Junglinster, Luxembourg, "Radio Luxembourg," 5 kw.
15.360—Moscow.
*15.360—Tokyo.
15.365V—Clandestine, "Espana Independiente."
*15.370—ZYC9, Rio de Janeiro, Brazil, "Radio Tamoio," 25 kw.
15.370—Budapest, Hungary, "Radio Budapest."
*15.370V—Lourenco Marques, Mozambique, "Radio Mozambique," 300 w.
15.370—. . . . . U.S.S.R.
*15.375—GRE, London, 50-100 kw.
15.380—Moscow.
*15.385—FHE, Dakar, Fr. West Africa.
15.390—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
*15.390—FHE, Dakar, Fr. West Africa, "Radio Dakar," 12 kw.
*15.390—KZRH, Manila, Philippines, "Voice of the Philippines."
15.390—Moscow.
15.400—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
15.400—ZMB4, Apia, Western Samoa.
*15.405—PZC, Paramaribo, Surinam, "Avros, Paramaribo," 2 kw.
*15.405—PZX5, Paramaribo, Surinam, "Avros, Paramaribo," 5 kw.
15.408—Moscow.
*15.411—Santiago, Chile, "Radio Sociedad Nacional de Agricultura," 500 w.
*15.420—GWD, London, 50-100 kw.
*15.420—HBZ4, Geneva, Switzerland, 40 kw.
*15.420—LRA7, Buenos Aires.
15.425—VRR11, Stony Hill, Jamaica, B.W.I., 500 w.
*15.430—ZOY, Accra, Gold Coast, 5 kw.
15.435—GWE, London, 50-100 kw.
15.438—Moscow.
15.440—Moscow.
15.450—GRD, London, 50-100 kw.
15.484—Clandestine, "Espana Independiente."
15.490—Soerabaja, Java.
15.500V—. . . . . U.S.S.R.
15.513—HDR, Quito, Ecuador, 2 kw.
15.530—Clandestine Polish ("Polska Walce").
*15.585—Salisbury, Southern Rhodesia.
15.595—Brazzaville, French Equatorial Africa, "Radio Brazzaville," 50 kw.
*15.630—ZAA, Tirana, Albania.
*15.660—JVE, Tokyo.
*15.665—SDT2, Motala (Stockholm), Sweden, 12 kw.
*15.692—HBZ, Geneva, Switzerland, 40 kw.
*15.750—Moscow.
15.780V—. . . . . U.S.S.R.
*15.835—HET5, Berne, Switzerland, 25 kw.
*15.855—HEO5, Berne, Switzerland, 25 kw.
15.860—DHTB2, Frankfurt, Germany.
16.860—JVD, Tokyo.
*15.875—HEK5, Berne, Switzerland, 25 kw.
15.880—FTK, Paris, 30 kw.
15.895—CR6RL, Luanda, Angola, "Radio Clube de Angola," 1 kw.
*15.915—CR6RL, Luanda, Angola.
*15.960—PLG, Bandoeng, Java, 3 kw.
15.960—CUJ2, Lisbon, Portugal.
*16.025—THA3, Algiers, Algeria, "Radio Algerie," 10 kw.
16.070—WXFD, Adak, Aleutian Islands, U.S.A.
16.105—SUV2, Cairo, Egypt, 10 kw.
*16.172—CR6RL, Luanda, Angola, "Radio Clube de Angola," 1 kw.
16.210—Ronne Antarctic Expedition.
16.320—COM3, Bissau, Portuguese Guinea, "Radio Bissau," 1 kw.
16.373—SUX, Cairo, Egypt.
16.666—CNR3, Rabat, Morocco, "Radio Maroc," 2.5 kw.
16.737—SUX2, Cairo, Egypt, 10 kw.
*16.909—Tabriz, Iran, "Radio Tabriz."
*17.170—Geneva, Switzerland.
17.260—Clandestine, "Espana Independiente."
17.290—Clandestine, "Espana Independiente."
*17.300—Brazzaville, French Equatorial Africa.
17.310—Ronne Antarctic Expedition.
*17.440—ZMB5, Apia, Western Samoa.
17.445—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
17.482—VWW3, Kirkee, India.
*17.530—Brazzaville, French Equatorial Africa, 800 w.
#17.565—Geneva, Switzerland.
*17.585—HBF2, Geneva, Switzerland, 40 kw.
*17.597—CRY7, Macao, Portuguese China.
*17.600—Brazzaville, French Equatorial Africa, 800 w.
17.630—PMW, Batavia, Java, "Radio Batavia," 2.5 kw.
*17.630—Moscow.
17.663—Shanghai (?), China, "The Chinese Broadcasting Co."
17.665—Clandestine, "Espana Independiente."
17.666—Paris, France.
17.675—Moscow.
17.675—Clandestine, "Espana Independiente."
*17.677—PZH, Paramaribo, Surinam, "Avros, Paramaribo."
17.685—GEU2, Royal Observatory (Greenwich).
17.690—Clandestine, "Radio Espana Independiente, Estacion Pyrenaica."
17.700—GVP, London, 50-100 kw.
17.715—GRA, London, 50-100 kw.

(*Continued on page* 132)

Practical Radio Course

(Continued from page 78)

(see Fig. 8B)—without need for the use for any actual physical condensers for the purpose. This circuit capacitance is the lowest value of capacitance that could possibly be had in the circuit. It is the sum of the wiring stray capacitance, capacitance of components to ground, and capacitance of tube-element to ground. These individual capacitances are shown dotted in Fig. 8B. Since the video intermediate-frequency involved is very high, component sizes and values required in the tuning circuits of the video i.f. amplifier are very much smaller than in the i.f. amplifiers of conventional sound broadcast receivers. The stray and distributed capacitances involved in the components, wiring, plate and grid elements, etc., therefore assume relatively greater importance. To keep the total distributed capacitance down to as low a value as possible, improved tube types having exceptionally low grid-input capacitance are used in video i.f. amplifiers.

In order to produce primary and secondary windings having the required amount of inductance without having to use many turns of wire (for this would increase the distributed capacitance of the winding and also some of the stray circuit capacitances) a low-loss, high-frequency type compressed-powdered-iron slug core is used in them to increase the permeability of the magnetic flux path. By making the position of the core in the coils adjustable, the inductance of the windings can easily be altered for making any slight resonance frequency adjustments that may be required at any time.

In many manufacturers' schematic circuit diagrams of television receivers, the distributed capacitances and tube-element-to-ground capacitances which act to tune the primary and secondary windings of the video i.f. transformers are not shown, so these transformers appear to be untuned. Whenever one of these diagrams is encountered remember that these circuit capacitances are being employed to tune the coils to the video i.f., even though they are not shown.

Another method of flattening the frequency response of video i.f. amplifiers is frequently used, either alone or to supplement the damping action of damping resistors shunted across the primary and secondary windings. This consists of the application of a slight amount of degeneration in several windings (usually the first three) of the i.f. stages. One very simple and effective way of accomplishing this is by not bypassing the entire cathode bias resistor of the i.f. tube. The circuit arrangement is illustrated in Fig. 8A. Grid bias resistors R_1 and R_2 *in series* together develop the total d.c. voltage drop required for use as the fixed grid bias for the tube. Resistor R_2 is adequately bypassed by condenser C_2 so no i.f. voltage drop is produced across it, and hence no degeneration is caused by it. However R_1 is not bypassed, so the i.f. voltage drop E_4 developed across it produces degeneration (since it is 180 degrees out-of-phase with the signal voltage variations in the grid circuit). It is evident that the amount of degeneration introduced can be easily controlled by properly choosing the resistance value of R_1.

Degeneration has another beneficial effect. Tube input capacitance is a function of the electron stream, and since the electron stream will vary with the variations in amplitude of the received video signal, this causes variations in the tube input capacitance. As the input capacitance of the tube (see Fig. 8B) represents an appreciable portion of the total distributed circuit capacitance that is effective for tuning the secondary of the video i.f. transformer to the video i.f., any variations in this capacitance may cause a sufficient variation in the resonance frequency to seriously detune the stage, with consequent reduction in gain and attenuation of the frequency-response characteristic. A small amount of degeneration serves to reduce this input capacitance variation sufficiently so that no harmful degree of frequency variation results.

Video I.F. Stage and Over-all Frequency-Response Characteristics

The rather complicated special over-all video i.f. amplifier frequency-response characteristic that is required, see bottom curve in Fig. 9A, cannot very well be obtained in each video i.f. stage. Consequently, it is current practice to produce a number of different, readily obtainable response characteristics in the several video i.f. amplifier stages such that the *over-all* response for the entire video i.f. amplifier will closely approach the desired characteristic.

The individual frequency-response characteristics of the five video amplifier stages of a television receiver *(Philco)*, and the resulting *over-all* response, are illustrated in Fig. 9.

When studying the shapes of such a group of individual-stage frequency response characteristics, and comparing them to the form of the resulting over-all response, it should be remembered that the over-all response at any frequency is proportional to the *product* of the individual-stage responses at that frequency—not to their sum.

It is also important to remember that the upper and lower cut-offs of the over-all response cannot exceed the minimum cut-offs imposed by the response characteristics of any stages in the series. For example, by referring to Fig. 9 it may be seen that the second i.f. stage is designed to have its low-frequency cut-off occur at approximately 21.7 mc. (slightly above the sound i.f. used). Now even though the low-frequency responses of the

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AIRCRAFT TRANSMITTER

Covers 540 Kc. to 9050 Kc. C.W. or fone, designed for Dynamotor Operation. Power supply requirements are 380 volts and 1000 volts DC.

Separate Ant. Tuning units covering the following frequencies.

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1500—3000 Kc.
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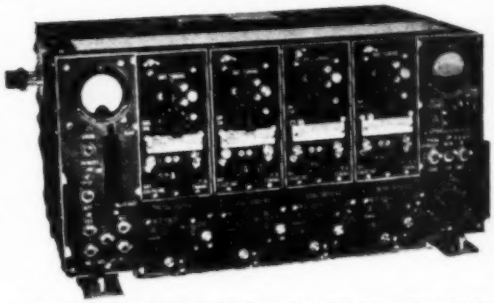
10½" high, 12¼" deep, 21½" long. Shipping weight 100 lbs. Price F.O.B. New York City.

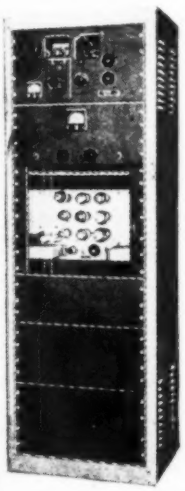


Tube line-up as follows: RF Osc. 6L6—RF Amp. 814—Audio —6SL7 Pre Amp. into 6L6 driver and side tone amplifier with pair of 6L6 modulators, screen of oscillator tube, regulated with VR 150 Tube. All circuits are metered.

FOR QUICK SALE—COMPLETE..... **$49.50**

MASTER OSCILLATOR MI-19427-B

This unit was built for R.C.A. Add a final—becomes a complete transmitter with signal shifter. Perfect for Television sweep circuits for field or station use or wherever 300 v. must be maintained under varying load conditions—



TECHNICAL SUMMARY

ELECTRICAL CHARACTERISTICS

Output Frequency	2 to 20 megacycles
Output Level, Buffer-Amplifier	Sufficient to drive an RCA-807
Modulation Frequency	650 cycles ± 150 cycles
Frequency Deviation (maximum)	± 500 cycles
Power Consumption	200 watts
Power Supply	115 230 volts, 50/60 cycles
Oscillator Filament Current	0.05 ampere d-c
Amplifier and Tone Generator Filament Voltage	6.3 volts a-c

TUBE COMPLEMENT

Electron-Coupled Oscillater	2 RCA-3Q5-GT
Buffer-Amplifier	1 RCA-807
Tone Generator	1 RCA-6AB7, 1 RCA-6F6
Regulated Power Supply	2 RCA-5U4-G, 5 RCA-6Y6-G 1 RCA-1852, 2 RCA-VR-150 30

MECHANICAL SPECIFICATIONS

Dimensions	Height, 66 9/10 in.; Width, 22 in.; Depth, 17⅛ in.
Weight	275 pounds

TYPICAL PERFORMANCE DATA

	Frequency Change
Line voltage change, ±10 per cent	0.0005 per cent
Temperature change, per degree Fahrenheit	0.0007 per cent
Relative humidity change of 1 per cent over the range of 30 to 95 at a dry bulb temperature of 110 degrees F	0.0003 per cent

Drift from cold start, first reading taken within 1 minute after applying power:
Frequency deviation at the end of the first hour a negative drift of 100-400 cycles (measured at 7 mc)

COMPLETE (LESS TUBES) $225.00

SPECIAL CLOSEOUT

SETCHELL CARLSON RADIO RECEIVER BC-1206-C

Designed to receive A-N beam signals. 24-28 vdc. Tube complement: 14A7, RF, 14H7, 14J7, 14H7, IF amplifier: 14R7, detector and 1st audio; 28D7, output, 195 to 420 KC 4" high x 4" wide 6⅝" long. Weight 4 lbs. perfect receiver for "Q fiver" described in QST.

Priced At Only ..... **$1.98** (Less Tubes)

Complete set of tubes for above $2.89 Extra

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20% deposit with all orders unless Rated
All prices F.O.B. N. Y. City

KITS!

KITS!

KITS!

TUBE KITS

Complete set of tubes for SCR-522
$17.95

Complete set of tubes for BC-348
$7.95

Complete set of tubes for BC-312
$7.95

Specify Model Numbers

POWER!! POWER!!

Niagara can supply a power supply kit which will completely power the ARC 5 Transmitter used as a VFO or any one of the ARC 5 receivers. All basic components included for delivering 300 v. @ 150 mills & 24 v. or 12 v. for the filaments—no rewiring of equipment necessary. This kit will also power the BC-348, BC-312, and the BC-1206. A good buy at **$7.50**

DO YOU OWN AN SCR-522?

We have a complete power supply containing all the necessary parts down to the line cord, pilot light switch & terminal blocks & delivers the following voltage—300 v. DC @ 250 mills, 150 v. of regulated bias and sufficient 12 v. to operate the tubes of both receiver and transmitter. Complete at the amazingly low price of **$14.95**

Model 200-EA. 5-ELEMENT 2 METER BEAM KIT. Folded di-pole driven element. All-aluminum construction. Feed with low impedance coaxial cable. Amateur net price **$8.40**

BC-348 Owners
CONVERTER for Broadcast Band

Convert that BC-348 without any alteration in your circuit. Our special converter takes power from receiver. Just tune your set to 450 kc. and forget it. All tuning is done on a converter panel covering 550 to 1600 kc.—double conversion means High Sensitivity. Excellent Fidelity and Higher Selectivity—complete basic kit with schematic and full instructions—less chassis dial and tuning knobs. Terrific Buy at..... **$6.50**

New... JUST OFF THE PRESS!

TELEVISION CATALOG

Send for Your COPY TODAY!

"TELEVISION IS HERE TO STAY." If you are thinking in terms of Television—whether you own a receiver or planning to build one—get Niagara's new giant Television catalog—all in one complete and comprehensive booklet on everything for Television. Kits, Components, Test Equipment, Antennas and miscellaneous—We have them all—Make us your TELEVISION HEADQUARTERS — you will save yourself considerable time and money. Clip this coupon.

TELEVISION

NIAGARA RADIO SUPPLY CORP
160 Greenwich St., New York 6, N. Y.

Please send copy of your Television Catalog to:

Name.....

Address..... Zone.....

City..... State.....

NIAGARA RADIO SUPPLY CORP.
160 GREENWICH ST., NEW YORK 6, N. Y.

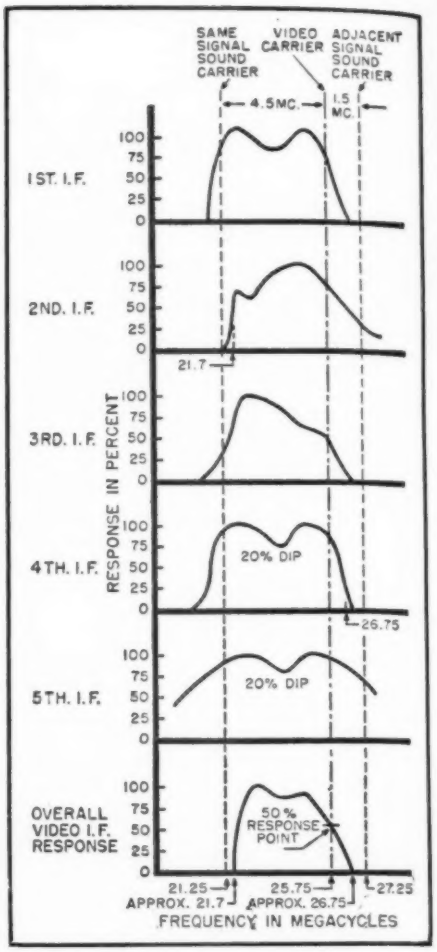


Fig. 9. Frequency response curves of each of the five individual stages, and the over-all response, for a five-stage video i.f. amplifier.

three stages that follow this all extend much beyond this frequency, this cut-off determines the low-frequency cut-off of the over-all characteristic, which is seen to occur (bottom curve) at approximately 21.7 mc. In other words, if the second i.f. stage attenuates to zero all signal components of frequency lower than 21.7 mc., no components of frequency lower than this can possibly get through to the third, fourth, and fifth stages and appear in the output of the last stage in the amplifier.

Similarly, the third and fourth stages are both designed to have their high-frequency cut-offs occur at approximately 26.75 mc. Therefore, even though the high-frequency response of the stage which follows this (the fifth stage) extends way beyond this frequency, this cut-off determines the high-frequency cut-off of the over-all characteristic, which is seen to occur at this same frequency—26.75 mc.

Observe that the over-all frequency response characteristic shown in Fig. 9 meets the video-amplifier specifications nicely. It rejects the 21.25 mc. sound i.f. signal that is associated with the video i.f. signal; it rejects the 27.25 mc. sound i.f. signal of the adjacent-channel transmitter; its response is down 50% at the video carrier frequency. —30—

How to Write an Ad

Are you paying for valuable space from which you are getting no return—make your ads pull!

By G. EDWARD DeNIKE
Morris F. Taylor Company

THOUSANDS of pages have been written on this subject and right this minute in hundreds of classrooms thousands of students are eagerly listening to instructors who are trying to instill the fine points of the art. And it is an art. It is the art of painting a picture with words, but unlike the product of the artist who uses brush and palette, the picture you paint in the wording of an advertisement must result in action on the part of the person who views it.

There is no single individual who can tell you an ad is good or bad. The resulting action of all who read the ad is the only practicable judgment of its quality. If the readers buy or expose themselves to personal sales persuasion as a result of reading your ad, it is good; if they don't, it's bad.

Naturally, as a result of the experience of reading, studying, and analyzing thousands of ads known to have been producers, certain fundamentals appear which may be considered good practice in writing an ad. By using these fundamentals, your ad has a better chance for success than if you ignored them. The use of known advertising fundamentals, however, is not an *assurance* that your ad will produce.

Again drawing the parallel between the artist and the person who paints a picture with words in an advertisement, you know that of the hundreds of thousands of persons who have learned the fundamentals of placing paint on canvas, few succeed in producing a result that is a "work of art." Nor can the theatrical producer who knows all the requirements of the show business be sure of a "hit." The comparison of advertising writing with theatrical production is even more to the point than with the painter, for the show depends for its success on its acceptability to large numbers of people. These comparisons are drawn so that you may be fully aware of the elusiveness of the factors which make your ad good or bad, make it pay or fail.

Before you attempt to write an ad, it will pay you to leaf through your local newspaper and the magazines you have around your home in the normal way you'd go through them at any time. If an ad catches your eye sufficiently to make you stop and look at it, or if you have the sensation of glancing back at it, then feeling that you want to read it, stop right there and ask yourself why. Was it an unusual use of words in the headline? Was it an illustration which commanded your attention? Was it a combination of both? Consider the ad as critically as you would a new model radio or appliance your jobber is persuading you to stock. The ad that stopped you is a "hot number." Why?

Having stopped you does the ad make you want to read all it has to tell or would you just as soon skip the detail?

Does the ad tell you about something you have been planning to buy anyway, or does it start you wanting something you hadn't thought of acquiring?

Finally, does it ask you to buy and tell you where you can buy? Now that you've really analyzed that ad, remember *your* ad has to do the same thing.

Your ad has to stop the reader, make him believe what he's read, and then stir him into action by making him phone, write, or come into your store so he's exposed to your personal sales-closing technique.

What's going to stop the reader? In the use of small space, the best way to stop him is with a few active, emotion-loaded words just like a newspaper headline. If there is room for a small illustration, use a device irregular in form and strong in line. Old, but always useful devices of this kind, include arrows, pointing hands, a number, an emblem; line drawing of a woman's head or photo of a woman's face expressing an emotion—joy, fear, adoration, worry, etc.; a cartoon of a person in action—running, jumping, falling, etc., a line cartoon or photo or a baby, dog, or horse. Such small thumbnail illustrations, if used, should tie in with and supplement the headline and lead the reader's eye to the body copy or descriptive wording of the ad.

The descriptive copy should be as brief as possible but sufficiently long to put across at least one idea having to do with the advantages and desirability of owning the product or securing the service advertised. Your ad should tell the reader how the product or service will accomplish one of a number of things for him, save him money, make him happier, save him work or time, protect him or his loved ones from danger, make friends, improve his social position, or entertain him.

The conclusion of the ad should never fail to ask him to buy, to ask for further details, to call, write, or visit your store. Who you are and where you're located is the final message. Have you ever been won over by an ad, only to be let down, yes, even irritated by the fact that the advertiser didn't tell you where he was located?

Study the advertising of merchants you know are successful in your town. See whether they are telling prospects some story which you can not only duplicate but improve on by making it more to the point, more interesting.

If your budget can stand large space, don't be tempted to waste it. Apply the same principles you would to a small space, but increase the factors in relation to the available space.

A most effective use of small space is to be found in the patent medicine ads. These ads, which run frequently in one, two, or three inches of space, often use no illustration or device for capturing attention other than their brief, bold headlines which play up to real or imagined human ailments and infer relief or cure. No, they're not pretty ads, but they sell merchandise. Elaborate testing precedes use of these little ads, constant checking proves they are paying out or they are stopped. Patent medicine advertisers are realistic. They don't spend money for the sheer joy of seeing their name in print. Their ads must pay dividends. View every advertising effort you make in the same cold, calculating fashion and you won't waste money.

A practical example of how you might apply the patent medicine or book selling technique is shown in Fig. 1. Let us say you have an ironer for sale. Which ad do you think would attract the most attention?

Fig. 1. Two ways of utilizing your advertising space. (1) Get the most for your ad dollar with an "eye-stopper." (2) Don't waste your money on non-pulling ads like this.

Housewife Banishes Agonizing Blisters

New ironing method saves delicate hands

Housewives who have let us show them how to use the new Zilch ironer wonder why they stood for ironing discomfort all these years.

Drop in. Let us show you this amazing new device. Free demonstration, no obligation.

Come to JONES APPLIANCE CENTER

000 S. State St. 9 a.m. to 6 p.m. (1)

Zilch Ironers Now in Stock

We have available the new Zilch Ironer which is finished in white enamel, has a ¼ horsepower motor, fine duo-therm heat control, and swivel joint top lifting mechanism.

JONES APPLIANCE CENTER

000 S. State Street

(2)

Number 1 is the winner, of course. You've appealed to your most likely prospect. You've put emotion into the headline. You've suggested a way to avoid harm in the subhead. Your body copy indicates that "others are enjoying this product, you too may end drudgery." You've asked the reader to do something about it, you've calmed their fear that they may be obligating themselves. You've told them where and when they can do something about it. Number 1 is an active ad, it appeals, moves, stirs desire to do something. Number 2 is static ad. You can't afford to spend your money on static ads unless you and your family simply enjoy seeing your name in print and you don't care whether or not your advertising space pays off.

Active ads are a living, driving sales force. Static ads just fill up space.

Take the example of a stationery store which captured attention by the the single word "LEBENSRAUM" as a headline. Went on to say "Space . . . extra working space is something every office needs! Here's an economical answer to the problem! This *all steel* typewriter stand is durable, attractive and practical. (Measurements are given and the two drop leaves are described as "handy" drop leaves.) Special at $5.85." Let's look at the copy, it sells this article as an answer to a problem—"extra working space," it touts the product as an "economical" answer to the problem, it emphasizes the durability, the appearance, the practicability. Then it clinches by suggesting this is a bargain—"Special" at $5.85. Maybe it's special and maybe it isn't, but that word connected with the price implies a worthwhile saving.

The ad concludes with the invitation to "Visit our big, new, complete Furniture Department—2nd floor, 000 S. Jones Street."

Before you try to put your ad together, spend some time analyzing a lot of ads. Do they leave you feeling "so what" or do they make you feel like buying something or at least investigating further. Ask yourself what it was about the ads that made you want to act. Be sure you get some of that "urge to act" stuff into the ad you put together.

Remember that you can't appeal to *every* reader, so concentrate your appeal on possible prospects. Since you are selling equipment for the home, you are talking to the ladies. Make use of the emotional appeals you know will interest them. Can your product make them more beautiful? Will it take drudgery out of their household tasks? Will it enable them to live a happier life, please their husband, win a boy friend? Will it make them the envy of their friends and neighbors? Will it save them money? If so, for goodness sake tell them. They're not interested in mechanics, construction, and drab operational details!

—30—

Within the Industry

(*Continued from page* 30)

years with *NBC* joined the staff of radio station WGY. In 1938 he became studio engineer and night manager of station WQXR in New York.

* * *

E. D. A. GEOGHEGAN is the new factory manager of the Chicago plant of *Solar Manufacturing Corporation.*

Mr. Geoghegan comes to *Solar* from *Tobe Deutschmann Corp.* of Canton, Massachusetts, where he was chief engineer. He was previously connected with *Polymet Manufacturing Corporation, Radio Corporation of America,* and *Sprague Electric Company,* in various engineering and production capacities.

One of the nation's leading authorities on paper condensers, Mr. Geoghegan will be in complete charge of the manufacture of the company's line of paper condensers for the radio, automotive, and electrical industries.

* * *

WIRE RECORDING CORPORATION OF AMERICA has recently been incorporated to take over the assets and manufacturing facilities of *St. George Recording Equipment Company* of New York City.

J. J. Sullivan heads the newly formed corporation which will consolidate the various manufacturing facilities of the *St. George Company* as well as sales offices in the company's new plant at 1331 Halsey Street, Brooklyn, New York.

The new company has completed plans for the manufacture and distribution of the "Wireway" wire recorder, a unit which will be available in both portable and cabinet models. Robert J. Marshall as chief engineer of the company is responsible for many of the developments which will be incorporated in the new unit.

Other officers of the new company include George F. Ryan, vice-president in charge of sales; Edward C. Gates, vice-president; and David Kestenbaum, secretary-treasurer. Advertising and sales promotion will be under the direction of Ab Waxman.

* * *

KENNETH C. PRINCE, Executive Secretary of the Association of Electronic Parts & Equipment Manufacturers and General Manager and legal counsel for Radio Parts and Electronic Equipment Shows, Inc., has announced the formation of a law partnership with his associate, Samuel Shoenberg.

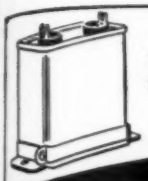
The new firm, which will be known as *Prince and Schoenberg,* has offices in Suite 1016, 33 North LaSalle Street, Chicago, Illinois.

* * *

ALEXANDER WELLINGTON heads the new *Air King Distributors Corp.* which will act as exclusive jobbers for the *Air King* line of home receivers in the New York metropolitan area.

Long associated with the industry, Mr. Wellington was most recently head of *Fada of New York.* He also traveled the entire country for *Fada Radio & Electric Co.* Prior to that he was merchandise

That servicemen are interested in television was demonstrated recently when 520 radio technicians from the Philadelphia area turned out for a video meeting sponsored by the Radio Electric Service Company of Penna. at their headquarters at 7th and Arch Streets, Philadelphia. The overflow audience heard John Meagher of Radio Corporation of America discuss the servicing of home television receivers.



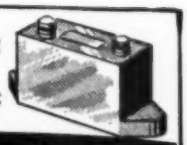
FILTER CONDENSERS

3 MFD. x 400 VAC. Good for about 1500 VDC. Metal can. Shpg. Wt. 3 lbs..... ONLY **98c**

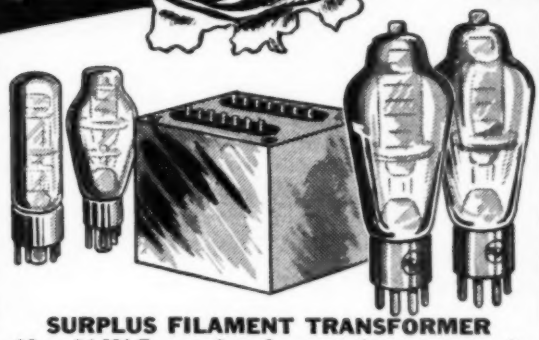
GET YOUR FREE COPY OF OUR NEW 1948 CATALOG

HV BY-PASS CONDENSER

.002 x 3000 VDC. Bakelite case. Shpg. Wt. ½ lb. ONLY **59c**



SMASH! BARGAINS IN SURPLUS EQUIPMENT



ARMY SURPLUS HEADPHONES HS23A

HS23A—Used but in A-1 electrical condition 8000 ohms impedance. Complete with leather headband and rubber cushions. Shpg. Wt. 3 lbs..... ONLY **98c**

HS-16A—Brand new, 2000 ohms impedance. Canvas web headband and long cord. Shpg. Wt. 3 lbs. **$1.47**

SURPLUS FILAMENT TRANSFORMER

12 or 24 VAC secondary for operating any one unit of the SCR-274-N Type equipment such as the BC-459-A, BC-696-A, BC-454-A and BC-455-A, or any similar unit. Pri. 115/230 VAC 60 cy. Metal Case. Shpg. Wt. 5 lbs.. ONLY **$1.47**

SURPLUS SPARE TUBE KIT

Complete set of spare tubes for BC-459-A or similar unit. Consists of 1—1626, 2—1625 and 1—1629. Brand new in original boxes. Shpg. Wt. 2 lbs..... ONLY **98c**

PLATE TRANSFORMER

No. 8931—1200/1400 VCT x 260 MA. PRI. 115 VAC 60 cy. Shipping Wt. 13 lbs. ONLY.... **$7.95**

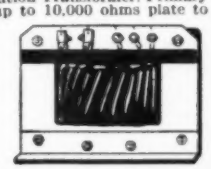
No. 4891 — 1200/1400 VCT x 200 MA. PRI. 115 VAC 60 cy. Shpg. Wt. 18 lbs. ONLY..... **$7.45**

FILAMENT TRANSFORMERS

Dual 5 Volt x 5.25 amps per section. Shpg. Wt. 8 lbs. PRI. 115 VAC, 60 cy. ONLY **$1.95**

MODULATION TRANSFORMERS

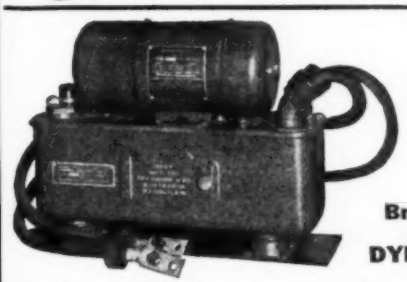
RCA 1 KW Modulation Transformer. Primary will match tubes up to 10,000 ohms plate to plate. Secondary No. 1, 450 MA. Secondary No. 2, 80 MA for beam, tube, screen grids. Shipg. Wt. 55 lbs. ONLY **$14.95**



30 Watt. Primary 5000 ohms CT. Secondary, 1750/2000/2250. Common B plus. Shpg. Wt. 6 lbs. ONLY..... **$2.00**

SELSYN MOTORS

No. 806—Navy surplus. Heavy brass case. Large continuous duty type. 115 VAC, 60 cy. Shpg. Wt. 25 lbs. Per Pair Only **$12.50**



Brand New PE-103 DYNAMOTOR

Brand new PE-103 Dynamotor. Will deliver 500 VDC at 160 MA with either 6 or 12 VDC input. Complete with overload circuits; filter and connecting cable. In original overseas shipping crate. Shpg. Wt. 81 lbs..... ONLY **$9.95**

Output plug for above: Cannon P8-CG-12S. Shpg. Wt. ½ lb..... ONLY **95c**

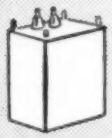
FILTER CHOKES

No. 8056—8 HY x 500 MA. 55 ohm DC. Res. Shpg. Wt. 28 lbs. Only... **$11.85**

No. 8783—2-6 HY x 500 MA Swinging Choke. Shpg. Wt. 28 lbs. Only... **$11.85**

No. 6317—4 HY x 300 MA. 40 ohms DC RES. Shpg. Wt.13 lbs. Only... **$4.95**

No. 4205-E—2.5 HY x 280 MA. 43 ohm DC Res. Shpg. Wt. 5 lbs. Only... **$1.49**



No. 10062—10 HY x 250 MA. 110 ohms DC Res. Shpg. Wt. 13 lbs. Only... **$3.49**

No. 0122—10 HY x 250 MA. 164 ohm DC Res. Shpg. Wt. 13 lbs. Only... **$3.95**

No. 2785—Dual 12 HY x 250 MA. 150 ohm DC Res. per section. Shpg. Wt. 17 lbs. Only... **$4.95**

No. 5269—4.5 HY x 150 MA. 79 ohms DC Res. Shpg. Wt. 6 lbs. Two for.... **79c ea.** One only... **99c**

W0JWD W0WTM W0PGI W0ULH W9NRF W0QDF W0IYD

Remember . . . your Trade-In's worth more at the Walter Ashe Store! So get Walter Ashe's offer before you make that trade.

TIME PAYMENTS AVAILABLE

Use this coupon to get Walter Ashe's "Surprise" Trade-in Allowance on your used factory-built test equipment. RN3

WALTER ASHE RADIO CO.
1125 Pine St., St. Louis 1, Missouri

☐ Am interested in the following top condition, slightly used Test Equipment _____ (list preference)

☐ I want to trade _____ (describe used equipment)

for _____ (show make, model of new Receiver desired or other equipment)

☐ Rush my FREE COPY of the big, New 1948 Walter Ashe Catalog.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Walter Ashe RADIO CO.

1125 PINE ST. • ST. LOUIS 1, MO.

MAIL COUPON TODAY

ALL PRICES F. O. B. ST. LOUIS

All the Big Name Brands of Receivers, Transmitters and Test Equipment in Stock . . . Ready for Immediate Delivery.

CHestnut 1125

manager for a retail chain of 44 stores in the East and Middle West.

Offices and showrooms of *Air King Distributors Corp.* are located at 5302 2nd Avenue, Brooklyn, New York, from which headquarters the company will service the entire New York metropolitan area including the buroughs of Manhattan, Bronx, Brooklyn, Long Island, and Westchester.

* * *

KENNETH KENYON has been named to the post of General Service Manager of *Philco Corporation.*

Joining *Philco* in August, 1942 as an instructor in the airborne radar school operated by the company for the Army and Navy, Mr. Kenyon was later assigned to a group of radio-radar field engineers for the Navy and served in the European and Atlantic theaters. In August, 1945, he was named television service manager for *Philco* and several months later was also placed in charge of the company's contact field service organization, including up to 535 field engineers assigned to Army, Navy, and Air Forces bases throughout the world.

In his new position as General Service Manager, Mr. Kenyon will coordinate the work of the radio and television, refrigerator and freezer, air conditioner and other departments of the *Philco Service Division.*

* * *

ALAN P. SCHREIBER has been appointed to the sales staff of *Tracerlab, Inc.* of Boston.

In his new position, Mr. Schreiber will be in charge of sales contacts with the chemical industry for new equipment, processed radioisotopes, and for development of industrial uses for radioactivity. He will also act as Editor of "Tracerlog," the monthly technical publication of the company.

Mr. Schreiber was previously associated with the Manhattan Project at Oak Ridge as Technical Advisor on patent matters and prior to that he worked with the Chemical Bureau, War Production Board, Washington, D. C.

* * *

GILBERT C. LARSON has been appointed chief engineer of the *Home Radio Division* of *Westinghouse Electric Corporation,* Sunbury, Pennsylvania.

A veteran of 15 years in the radio industry, Mr. Larson will be in charge of all engineering for the company's extensive line of home receivers, including FM and television units. Prior to accepting his new position, Mr. Larson was an engineering executive with *Hazeltine Electronic Corporation.*

Upon his graduation from the University of Washington with an electrical engineering degree, Mr. Larson joined the *Buckley Radio Company* in Seattle as an engineer. He held a similar post with *Colonial Radio Cor-*

poration, and resigned as engineer-in-charge of the *Colonial Production Laboratory* to join *Hazeltine* in 1941. He is a senior member of the IRE.

* * *

ROLAND D. PAYNE who recently conducted a series of 33 meetings for the company at metropolitan centers covering the servicing of FM radio sets, has been appointed to the important post of Sales Manager of service test equipment for the *Specialty Division* of the *General Electric Company*.

In his new capacity he will be in charge of the sale of the division's line of radio test equipment for the serviceman and other users.

Prior to his present appointment Mr. Payne worked in the service test equipment sales section. He recently returned from a 10,000 mile, three-month tour of the country during which trip he conducted the service meetings.

Mr. Payne joined *General Electric* in April, 1945 and was assigned to the Philadelphia office of the company as district representative in charge of sales for the *Tube* and *Specialty Divisions*. He was formerly sales manager of *Danforth Company* of Pittsburgh and also managed a manufacturers' agency there for twelve years.

* * *

WILLIAM O. SPINK has been named field engineer for the *Radio Division* of *Sylvania Electric Products Inc.* according to word received from the company recently.

Mr. Spink, who will cover the Michigan, Ohio, and Indiana territories, will report to Philip Pritchard in the *Radio Division's* Cleveland office in the Union Commerce Building. He will replace D. W. Gunn who has been transferred to the New York office where he will serve as special sales representative for the company's *Radio Division*.

—30—

The Federation of Radio Servicemen's Associations of Pennsylvania recently awarded a plaque to Howard W. Sams "in recognition of his outstanding efforts in behalf of the radio service industry." The scene of the presentation was the FRSAP's convention dinner.

Converting BC-696-A

(*Continued from page* 59)

means of K_{83}, and positive high-voltage keying, it was finally decided that keying the "B-minus" provided the best signal with the utmost safety; furthermore, it allowed the insertion of an effective click filter in the keying circuit.

Incidentally, it was found that regulation of the oscillator plate voltage alone or in conjunction with regulation of the final screen voltage resulted in a decided chirp. In addition, it was found that reducing the plate voltage of the oscillator from 190 to the 150 volts with the VR tube resulted in a noticeable reduction in drive to the final. This does not matter except when it is desired to get the maximum power from the final.

Various methods can be used to couple to the antenna. If a doublet is used, the variable inductance can be reduced to minimum and the variable link can be coupled directly to the coax, twin-lead, etc. For lengths up to thirty or forty feet, the antenna can simply be attached to the antenna post and a good ground attached to the case. Lengths to around seventy feet can be matched by placing a variable condenser of some 50 $\mu\mu$fd. between the antenna post and the antenna and adjusting the variable inductance. For feeding a half-wave antenna directly on the end, a link can be run from the antenna post and chassis to a secondary tank circuit tuned to the frequency and with the end of the antenna attached to this tank circuit.

Any modulator supplying around twenty to twenty-five watts of audio may be used. A pair of 6L6's in Class AB_1 will serve admirably. The secondary of the modulation transformer is attached to a cable terminating in a plug for insertion in J_1 of the power supply.

I find that 100 mils. on phone and 150 mils. on c.w. are good inputs to use. This represents 50 and 75 watts respectively. At 100 mils., the modulation transformer is working into a 5000 ohm load.

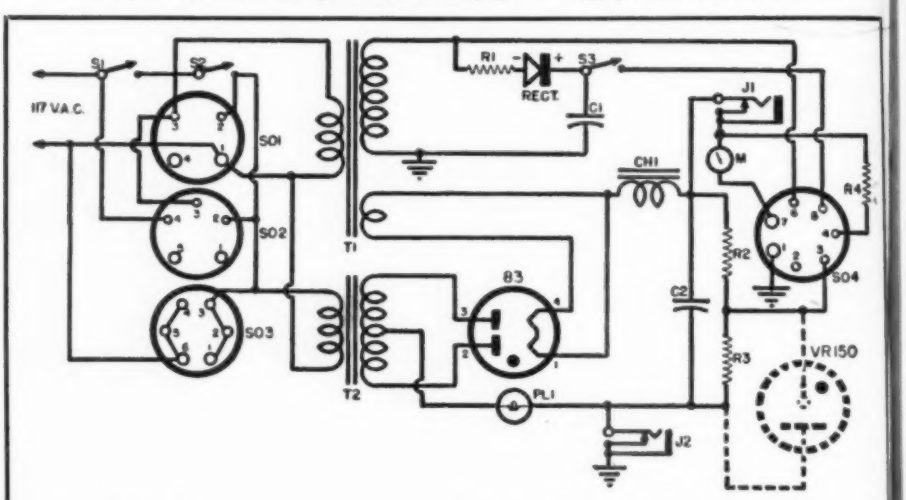
Advantages of using the combination power-supply and control box are twofold: First, such a method requires a minimum of changes in the transmitter proper, and this is important in a fine piece of frequency-calibrated equipment such as the BC-696-A. Second, others may like to do as the author has done and buy a BC-459-A and equip it with a similar cable. Either transmitter can then be used by simply plugging it into the power supply; and there is no needless duplication of equipment.

This transmitter was put on 75-meter phone at the author's central Indiana location at nine o'clock in the evening, and within thirty minutes QSO's were had with a W1, a W8, and a W9. All reports were of excellent quality, good clean modulation, and S-meter readings of better than 9.

The modulator plug was then pulled out and the key plugged in. The frequency was adjusted to the 80-meter c.w. band. Within an hour the second, third, and fifth districts were worked. The weakest strength was S7, and all tone reports were T9X. Time and again the author has been politely called a liar for saying he was running only fifty watts to a BC-696-A.

The author would like to point out that the ARC-5, T-18 to T-22, trans-

Fig. 5. Schematic diagram for building power supply and control unit.



R_1—40 ohm, 2 w. res.
R_2—15,000 ohm, 10 w. res.
R_3—100,000 ohm, 1 w. res.
R_4—20,000 ohm, 10 w. res.
C_1—40 μfd., 50 v. elec. cond.
C_2—10 μfd., 600 v. elec. cond.
S_1, S_2, S_3—S.p.s.t. toggle sw.
SO_1—4-prong socket
SO_2—5-prong socket
SO_3—6-prong socket
SO_4—Large 7-prong socket
Rect.—100 ma. selenium rectifier
J_1, J_2—Closed circuit jack
CH_1—10 hy., 200 ma. filter choke
T_1—Fil. trans., 24 v. @ .9 amp., 5 v. @ 3 amps. (See text)
T_2—Plate trans., 600-0-600 v. @ 200 ma.
PL_1—#46 pilot lamp (used as fuse)
M—300 ma. d.c. meter
1—83 tube
1—VR150 tube (See text)

C-1 AUTO PILOT

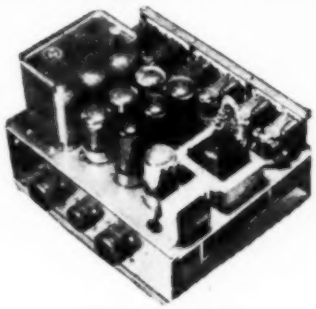
Complete with one each unit shown "In Box" below. Any experimenter or boat owner cannot be without this equipment which cost the Government thousands of dollars but offered you at the small price of..... **$30.00**

C-1 AUTO PILOT COMPONENTS

C-1 AUTO PILOT CONTROL BOX

Used for aligning control of C-1 Auto Pilot or use for parts, etc. Contains many useful pots., toggle switches, plugs, etc. Size, 11"x 6"x4½".

PRICE **$3.75**



C-1 AUTO PILOT AMPLIFIER

Used to control operation of servo unit in response to signals received from gyro unit and control unit. The complete amplifier includes one rect. 7Y4, 3—7F7's for amplification and control, 3—7N7's for signal discrimination, 1 power transformer, 6 relays, 4 control pots, chokes, condensers, etc. Convert for use on radio controlled models, doors, etc. Operates from 24 V. DC. Size, 9¼"x6¼"x 7⅞"..... Complete

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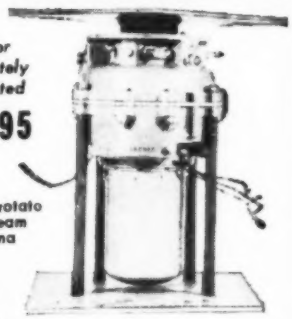
C-1 SERVO UNIT

Use to rotate beam antenna, actuate boat rudder control, etc. Contains 24 V. motor, clutch, relays, etc. Reversible. Size overall approx. 10½"x8½"x 6½"..... PRICE **$12.50**

C-1 GYRO

Part of the C-1 Auto Pilot which is sold separate and may be used to conduct many interesting and amusing experiments. Operates from 24 V. DC or may be operated for short periods on 110 V. AC. Gyro will run for approx. 15 minutes after actuating. Size—approx. 8"x8½"x8½"..... PRICE **$8.95**

BEAM ROTATING MOTORS



Motor Completely Converted

$17.95

Used to rotate your beam antenna

Motor Only 24-28 V.

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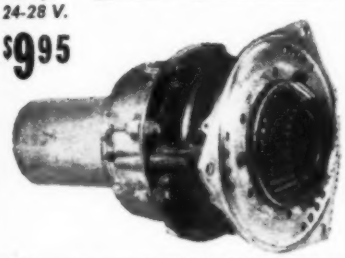
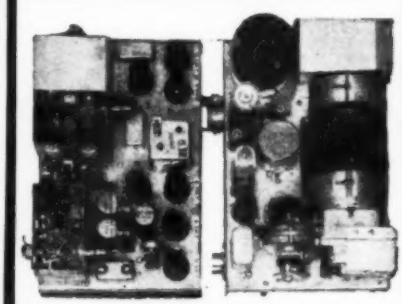
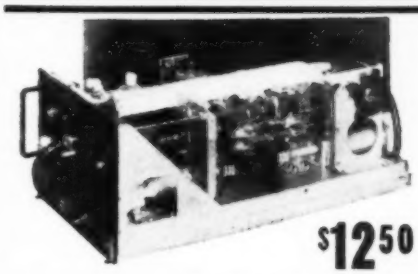


Transformer to operate 110 V.-30 V. (New) 4.95



BC-966-A IFF

Approximately 2 meter frequency operation. 14 tubes, 350 V. DC dynamotor, 12 V. DC input. Contains voltage regulators and many other fine parts. Worth more for parts than price asked.... **$4.75**



$12.50

T/39/APO.-9 RADAR XMITTER

Contains many excellent parts for the VHF experimenter such as a cavity oscillator using 2—RCA 8012 tubes rated at full output to 500 Mc. Tubes are forced air cooled by 24 V. DC motor, which is easily converted for 110 V. AC operation. Other valuable parts such as a pair of 807's, 2—6AC7, 1—931 and 1—6AG7 tubes; ceramic switch, potentiometers, gears, revolution counter, etc.

BC-348 COMMUNICATIONS RECEIVER..... $69.50

6 bands, 200-500 Kc. and 1.5-18 Mc. 2 stages RF; 3 stages IF, BFO, crystal filter, manual or AVC. Complete with tubes and 24 V. dynamotor. These receivers have been thoroughly checked in our work-shop and found in excellent condition.

BC-348, 110 V. AC power supply, including simple conversion instructions. Complete with tubes.

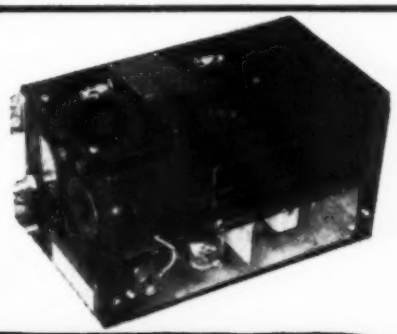
$8.95

TRANSMITTER RU-19

With plug-in coils not included cover a frequency range of 3000-4525 and 6000-9050 Kc. Contains 4 tubes. Size, 6½"x6½"x11". PRICE..... **$5.00**

RECEIVER RU-19

With plug-in coils not included cover a frequency range of 195-13,575 Kc. Contains 6 tubes. Size, 6½"x6½"x15"..... PRICE **$5.00**



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mitters *are not,* as some think, identical with the 274-N transmitters. The ARC-5 is plate and screen modulated by a pair of 1625's in push-pull, driven straight out of a carbon-button mike transformer. The modulation transformer has separate plate and screen windings. The tank circuit of the final of the ARC-5 unit is parallel-fed instead of being series-fed, as is the BC-696-A. The input-socket connections of the ARC-5 unit are different from those of the BC-696-A. However, the numbering of parts used in both transmitters is identical; i.e., "R_{11}" in a BC-696-A has the same value and is used in the same place as "R_{11}" in an ARC-5. Values peculiar to either carry a number not used in the other.

In conclusion, the author wishes to acknowledge his deep indebtedness to W9RJU, W9BRY, W9EGQ, W8EQ, and W8HB for their many suggestions and valuable bits of information in connection with the converting of this transmitter.

—30—

THREE-ELEMENT ROTARY BEAM FOR LESS THAN $5.00

By W. E. WHEAT, W5LYD

THERE is so much controversy over how many elements a 10-meter beam should have that the writer will say nothing on the subject. The same applies to the method of feeding the driven element, suit your own tastes, use any of the standard formulas and put on as many elements as you like. You can use five elements close or wide spaced and still have a strong, light, economical efficient beam. In the drawing you will see a three-element array which was conceived and constructed at the home QTH and with this little beam on the end of my single 807 and its 60 watts I have had phenomenal success with DX, groundwave, and W contacts. The total cost of the entire array, including the rotating mechanism was less than $5.00.

There is nothing complicated about the construction as can be seen from the drawing.

The tower or mast used in the installation was simply a piece of 8x8″ cypress 16′ in height. This height was selected because it would enable us to stand on the roof of the shack and work on the beam.

The boom is a cypress 2x4″ with holes drilled to fit the bamboo poles. When the large end of the poles are passed through these holes about 12″ they can be lashed as shown. In the event the bamboo poles are not available, any light wood strip ¾x¾″ about 16½′ long will do just as well. Right here it should be remembered that whichever type is used the poles should be attached to the beam at the exact spacing necessary for the particular type beam to be constructed, and the insulator mounted immediately above. Next the insulators are fastened to the ends of the poles. The elements are then cut to the desired length and all pass through the eye of the insulator mounted on the boom, where they are anchored at their exact center. Next attach an 8 inch metal pulley, as shown, on the bottom of the boom at the point where the weight will be balanced. A 40-penny nail was then driven through the boom so it would pass through the hole in the center of the pulley and go down into the 8x8″ far enough to hold the array steady but not tight. A rope was then put around the pulley and brought down over two bracketed pulleys mounted at right angles to the 8″ pulley on the face of the 8x8′. These ropes rotate the beam adequately, however, small flexible wire would do better since it would not require tightening after installation.

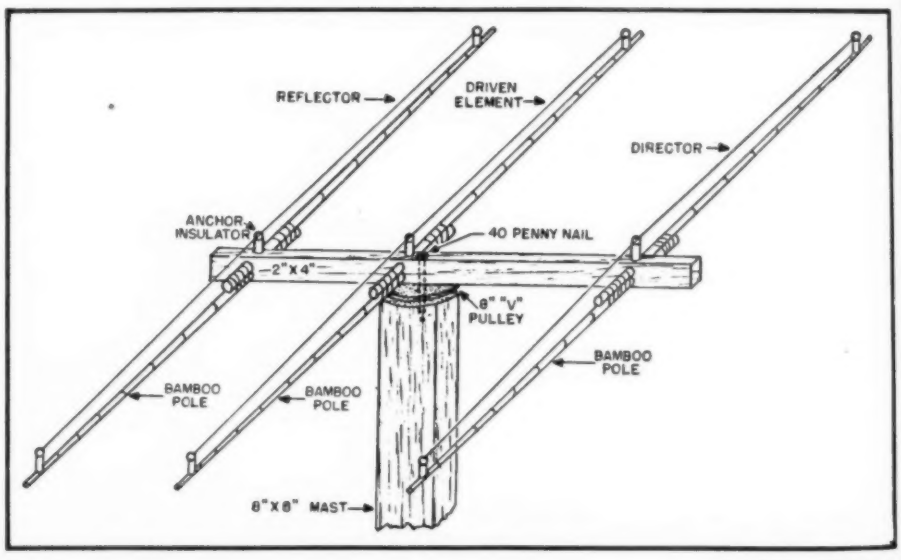
All the elements for the three-element array can be made from the 50′ roll of aluminum clothes line wire now being sold in most grocery and hardware stores.

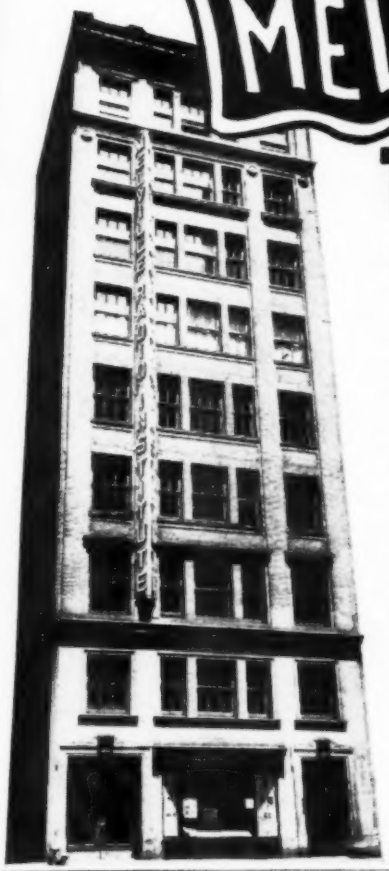
The insulators used on the ends of the poles were 6″ Johnson Spreaders. The center insulators or anchor insulators were 1½″ brown porcelain with 1½″ screw base.

Another bamboo pole can be lashed along the ends of the beam giving it added strength so that strong winds will not affect the element spacing.

—30—

Assembly details of 3-element, 10-meter antenna.





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SCR-522 VHF TRANSCEIVER

100 to 156 MC. Makes a fine economical 2-meter rig, taxicab radio, aircraft set, etc. Comp. w/17 tubes. Excellent condition.....$22.95

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For A1, A2 and A3 emission, useable from 200 Kc to 20 mc. Uses 4—211's and 1 type 10 tube. Plate, Fil and RF Meters. Antenna matching network. Comp. w/tubes, one tuning unit, wired for 24V operation.....$18.95
BC-191—Same as above, except wired for 12V operation.....$19.95

PORTABLE BURIED METAL LOCATOR

SCR-625 Army Mine Detector, will detect small amounts of any type of metal buried several feet underground. Easy to operate; both sound and meter indicators. Uses flat round light disk with 6' handle and small battery operated amplifier. Tested before shipment.....$49.95

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Small portable 2-wire telephone. Generator, bell handset, etc. Excellent for farms, contractors, mines, etc. Requires only 2 flashlite batteries. Tested before shipment. Each $8.95.....Pair $15.95

HANDSET TS-13

200-ohm carbon mike and 2500-ohm earphone with butterfly switch. Has 6-ft. rubber covered cord with PL 55 and PL 68 plugs.....$2.95

GIBSON GIRL TRANSMITTER

SCR-578, Emergency Transmitter, comp....Each $24.75

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Brand new! 9.4 KVA, gasoline engine power plant. Army PE-182. 115V, 230V, 440V, single or 3-phase, 60-cycle. Mounted on sturdy steel skid. Export packed, with spare parts and tools. Photo and more info upon request. Regularly $1800.....Our Price $699.00

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Standard, L. C. Smith, Remington, Underwood, 10, 11, 14 and 20" carriages, Pica and elite type. Standard and Signal Corps Keyboard. Reconditioned. Excellent. Satisfaction guaranteed.....$59.50

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Very suitable for Universities, Schools, Radio Shops and HAM'S.
If you cannot get to the Government Sales of War Surplus Radio Equipment the next best thing to do is to buy our SPECIAL $25.00 GOVERNMENT RADIO SURPLUS ASSORTMENT.
We buy large quantities of these items all over the country, divide those items we don't have in large quantities into choice assortments, for which we know you would gladly pay $25.00 if you could see them.
On a deposit of $5.00 we will ship you COD (balance $20.00) freight collect, a large quantity of Government Surplus Radio Items subject to your inspection. If, after inspection you are not more than satisfied, return to us, freight collect and all it will have cost you will be freight charges one way. We will then refund your initial payment of $5.00.
You should be able to dispose of a few of the items that you may not need for the entire cost.

$2.00 Minimum—PLEASE!

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BC-221 FREQUENCY METER

A heterodyne frequency meter comp. w/tubes, crystal, calibration chart. Range is 125KC to 20 MC. Can be used with 110 volts AC power pack, batteries or vibrapack. Makes a fine signal generator or converts to VFO. These are slightly used. Tested before shipment.....$37.75

THE BEST ANTENNA MOUNT

we have ever seen. Rotating Ball-Bearing Head. Takes 2" OD shaft that can be clamped. Stands 11' high on 3 supports made of 2 sections of 2" phenolic tubing. Does not need guying or RF isolation.....$14.95

ELECTRIC MOTORS, 110V, 60 CYCLE

1/20 HP, GE Capacitor Start, 2800 RPM.....$12.95
1/20 HP, GE Capacitor Start, 1725 RPM..... 12.95
1/4 HP, Jack & Heintz, Capacitor Start, 1725 RPM 19.60
1/3 HP, Jack & Heintz, Capacitor Start, 1725 RPM 27.20

1¼" ANTENNA MAST SECTIONS

5' long, with 6" extension. Can be nested to any length desired. Light alloy. Strong.....Each $1.95

24' WHIP ANTENNA

Screw in 3' sections with insulated mount.....$9.95

110V ¼-WATT NEON LAMPS

Bayonet Base, T 4½ bulb.....10 for $1.20
Candelabra Base, T 4½ bulb.....10 for 1.90

INSULATED 90' MAST FOOTING

Lapp compression insulator with spark gap. Used by the Army to support and insulate their 90' metal towers. 15" of glazed porcelain, insulating surface, protected from snow by galvanized steel hood. 16" H. x 14" max. D....$44.95

MISCELLANEOUS

Safety belt, with strap. State belt size.....$5.75
Lineman's Pole climbers..... 4.50
Auto Spark Plug Suppressors.....50 for 2.25
Handset Cordage. 3-conductor RC tinsel. Woven jacket. Minimum order 25'.
25' to 99'....per ft. 4c. 100 to 1000'.....per ft. 6c
RG8/U Coax, 52 ohm, minimum order 100'....per ft. 6c
Cable, 3-conductor No. 18 stranded, 600V insulation 250, rubber covered. 43" OD, 1 conductor shielded. Russel Stoll connectors each end No. 8158 and 8098. Signal Corp Type CD-520.....$5.95
Cable, 7-conductor, No. 14 stranded, 600V insulation. Heavy duty RC, 65' long. Connectors both ends. ⅞" OD.....$4.95
Cable, 14-conductor, No. 15 stranded, 600V insulation. Crush-proof cotton core. Heavy duty RC 50' long connector 1 end, plug other end.....$4.95
12-16V Panel Lamp, 100MA, T 3¼ bulb, Bayonet Base. 10 for.....59c
Asbestos Gloves, Heavy Duty, suitable for welders, hot material. Sizes 10 and 11.....Pair $1.25

TV Exclusively!

(*Continued from page 49*)

amount of time, and then the pulled chassis is replaced with a temporary unit.

So far, there is nothing to indicate that sales are being made to a particular income group, or that business would be better if a higher, or lower income bracket were concentrated upon.

Everyone who has seen a television show, wants a television set. This broad statement is substantiated by the fact that the majority of television sets are financed.

The only real limitation on sales that has been encountered so far is the shortage of merchandise. There still aren't enough of the popular sets to meet the demand.

Salesman explains to the "teletheater" audience why specialized installations are needed for good television reception.

It should be interesting to see whether or not the rest of the retail television industry will follow John Porterfield's lead, and whether or not television will do as the automobile did, and leave the bicycle shop and move into the showroom.

—30—

"Are you the one who phoned?"

CODE OF ETHICS

THE Associated Radio Servicemen of New York, Inc. is distributing copies of the organization's "Code of Ethics" to member-servicemen as part of its active campaign to eliminate servicing abuses and render unnecessary the proposed legislation for licensing of servicemen now before the New York City Council.

The code, which each member is asked to read and sign, is as follows:

"1. I will at all times, without any exceptions, perform my work to the very best of my knowledge and ability. In addition, I will make a sincere effort to improve my knowledge of the technical and business requirements of my job, thereby enabling me to render still better radio service.

"2. I will conduct myself and my business in an honest and straightforward manner, meriting and inspiring the confidence of my customers.

"3. I will, whenever practicable and desirable, prefer to use original factory replacement parts. In other cases, I will use replacement parts known to be of equal or better quality, thus insuring satisfactory performance.

"4. Realizing that an extremely low price does not permit good workmanship and an unreasonably high price will prompt justifiable criticism and loss of patronage, I propose to charge a just and fair price for all my work, based upon my ability and qualifications to render satisfactory radio service.

"5. I will guarantee all radio work performed, which has been authorized and for which payment has been received, for a minimum period of not less than 90 days, and will give each customer an itemized bill.

"6. I will exercise all reasonable care in handling my customers' property.

"7. I will not engage in any unfair or unethical practices condemned or disapproved by the Associated Radio Servicemen of New York, Inc., such as misleading or untruthful advertising, making unreasonable promises or statements, unjustly criticizing a fellow man's actions or ability and such other practices as may be brought to the attention of the Associated Radio Servicemen of New York, Inc., that would lead to an unjustifiable lack of confidence in the A. R. S. of N.Y., or any of its members.

"For the mutual benefit of my customers, fellow members of the Associated Radio Servicemen of New York, Inc. and myself, I hereby subscribe to the above A.R.S. of N.Y. Code of Ethics." —30—

SCOTT DYNAMIC NOISE SUPPRESSOR DATA

COMPLETE details for building the suppressor into the recording amplifier (January, 1948 issue, page 54) will appear soon in Radio News. Readily available chokes and other components have been chosen for the circuit that will enable builders to duplicate the excellent performance of the laboratory model.

Other minor improvements have been made in the amplifier. These too will be shown. Many readers have requested circuits and data for utilizing other types of tubes and controls in their possession as substitutes. Generally such changes are not recommended and would result in a poor facsimile of the original. —30—

Simplified RC BRIDGE

Front panel view of home-built RC bridge.

By R. L. PARMENTER, W1JXF

Low-cost shop instrument provides means of measuring resistances from .1 ohm to 1000 megohms and capacitance from 1 μμfd. to 1000 μfd.

KEEPING in mind the fact that the average experimenter will steer clear of apparatus that seems to be too complicated or too difficult to construct, a resistance-capacitance bridge that has been stripped to its bare essentials is being presented. Using two or three tubes and requiring only a few easy-to-get parts the bridge retains a high degree of accuracy (comparable to a good ohmmeter) and is easy to build and operate. It is a self-powered unit and contains its own null detector, thereby eliminating the necessity of tedious hookups to put it into operation. The basic circuit as developed by Rufus P. Turner (RADIO NEWS, April, 1947) has been somewhat simplified. For the experimenter and beginner it offers a means of measuring capacitance and extending the range of resistance measurement. The average builder should find merit in this simplified version.

The ranges provided are the same as in the original version: 1 μμfd. to 0.1 μfd., 100 μμfd. to 10 μfd. and 0.01 μfd. to 1000 μfd. for capacitance and .1 ohm to 10,000 ohms, 100 ohms to 10 megohms, and 10,000 ohms to 1000 megohms, for resistance. A change-over switch is used to read either resistance or capacitance. Readings are taken directly from the main dial and multiplied by the proper factor as indicated by the range switch to achieve direct reading. It should be noted here that the upper limits of the above ranges are not usable except for relative values due to crowding on the dial. However, there is sufficient overlap on the ranges so that all intermediate values may be read accurately.

The Resistance Circuit

A Wheatstone bridge circuit is used for resistance measurement and with it we can achieve a degree of accuracy equal to that obtainable from the average ohmmeter. While direct current is customarily used for this type of circuit it is just as feasible to use alternating current if the values in the circuit are pure resistance. Inductances cannot be measured with this bridge nor can resistances having an inductive component be measured accurately. The a.c. measuring voltage at 60 cycles is derived from a 2:1 audio transformer which is tied in with the secondary across the 110 volt line. When used in this manner the usable potential is in the neighborhood of 55 volts which is sufficient for the amplifier and detector as used.

The simplified "resistance circuit" is shown in Fig. 1A and will be recognized as the familiar Wheatstone bridge with amplifier and detector added. R_x is the unknown resistance, R_s the standard, R_a and R_b the variable values on either side of the arm of the potentiometer which are calibrated to the dial. By varying the position of the potentiometer arm the proportions of R_a and R_b are changed to arrive at the null point. Under these conditions no difference of potential exists across points A and B, no voltage is being amplified and no signal is being applied to the grid of the 6E5. The shadow on the tuning eye is opened to maximum and the proportions:

$$R_b \times R_x = R_a \times R_s \text{ and}$$

$$R_x = \frac{R_a \times R_s}{R_b} \text{ hold true.}$$

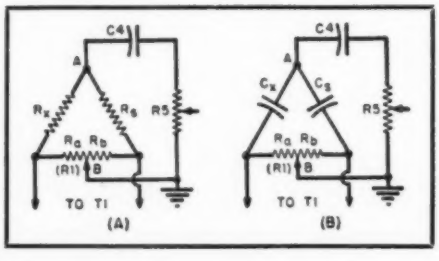
Similarly, for the Wien bridge (Fig. 1B):

$$C_x = \frac{C_s \times R_b}{R_a}$$

In other words the position of the potentiometer arm at null is an interpretation of the above proportions and may be expressed in dial degrees. When the bridge is off null, a difference of potential exists between points A and B and a voltage is amplified and applied to the grid of the 6E5. Since this tube is a voltage measuring device any change of potential at its grid will show up as a change in its fluorescent pattern. With maximum signal the eye closes so when tuning the bridge the operator tunes for maximum eye opening. It is used in a reverse manner from that customarily used on a receiver where the eye is tuned for minimum eye opening.

The circuit as used for capacitance measurement is shown in Fig. 1B in its simplified form. In this case C_x is the unknown condenser, C_s is the standard and R_a and R_b are the same as before—the variable values of the potentiometer. The same method of operation as was used for resistance is used in this case except that the two arms of the bridge with capacitive reactance are balanced with the resistance of the potentiometer. In other words the potentiometer is calibrated for capacitance in terms of resistance. The bridge in this case is known as a Wien bridge and is in the familiar old form, long used for the measurement

Fig. 1. Basic circuit (A) for resistance measurement is the Wheatstone Bridge: while the familiar Wien Bridge circuit is used for capacitance measurement (B).



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100 assorted **$3.85**

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50 mica condensers. All brand new—standard color coded.
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Has 7 Important Features:
1. 4 W. Audio Output.
2. Gain enough for Phonograph, Radio, F.M. Tuner, Carbon Mike.
3. Hi-Fi response, 50-20,000 C.P.S.
4. Variable Tone Control.
5. 3 section filter assures extremely low hum level.
6. Push-Pull balanced output.
7. Heavy Duty Universal Output Transformer.

All parts included to build this unit . . . tubes: 2—35L6; 1—12SL7; 1—35Z5; Punched chassis, 6" P.M. Speaker, diagram, pictorials, output transformer, etc., etc. Kit complete as shown **$7.75**

TUBES !!

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1A5	$ .50	6SJ7	$ .50	14A7	$ .95
1A7	.60	6SK7	.50	14B6	.75
1LC6	1.10	6SL7	.75	14R7	.75
1LH4	1.10	6SN7	.60	25Z6	.60
1LN5	1.10	6SQ7	.50	26	.50
1N5	.60	6SR7	.50	27	.50
1R5	.75	6V6	.50	30	.50
1S5	.75	6X5	.75	31	.50
1T4	.75	6Y6	.75	35A5	.60
2C26	.50	7A8	.60	35L6	.60
2C40	1.00	7B6	.60	35W4	.50
3B24	1.00	7C5	.60	35Z5	.60
3Q5	.75	7C6	.60	39/44	.50
5U4	.50	7C7	.60	50B5	.60
5Y3	.50	7E5	.50	50L6	.60
6A8	.60	7F8	.50	50X6	.75
6AC7	.75	7G7	.95	50Y6	.50
6AG5	.75	7N7	.50	75	.50
6B4	.95	7Y4	.60	76	.50
6C4	.50	12AH7	.75	77	.50
6C5	.50	12AT6	.50	78	.50
6H6	.50	12BA6	.60	80	.50
6J5	.50	12BE6	.60	84/6Z4	.50
6J6	.50	12C8	.50	117L7	1.10
6J7	.60	12J5	.50	VR105	.75
6K6	.50	12SF7	.50	VR150	.75
6K7	.50	12SG7	.60	826	.50
6S8	.50	12SK7	.60	954	.75
6SA7	.50	12SJ7	.50	955	.75
6SD7	.60	12SN7	.50	956	.75
6SG7	.50	12SQ7	.60	9001	.50
6SH7	.50	12SR7	.60	9006	.50

Deduct 10% from all tube orders $20.00 or over.

Deduct additional 5% from orders of 100 tubes of one type.

All items subject to prior sale. All prices subject to change without notice.

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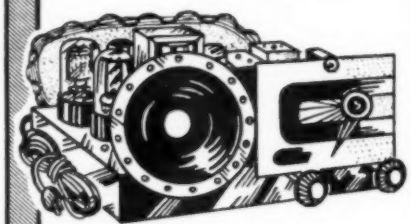

Several models built directly from this kit are now giving thoroughly dependable performance and beautiful tone. Engineered for simplicity of construction, this set will also give you the utmost in listening pleasure.

NO FOOLING—There's nothing weird or tricky about this set. Uses a standard superhet circuit. 6 tubes. 2 RF stages, 1 DF stage, 12SA7 converter, 12SK7, IF amp., 12SQ7 detector, and 1st audio, 12SK7 1st IF, 35L6 output, 35Z5 rectifier.

KIT CONTAINS punched chassis, 6 tubes, 2 IF's, loop antenna, 5" PM speaker, diagram, pictorials, all resistors and condensers, **and every last bit of hardware required.** Nothing else to buy except cabinet.

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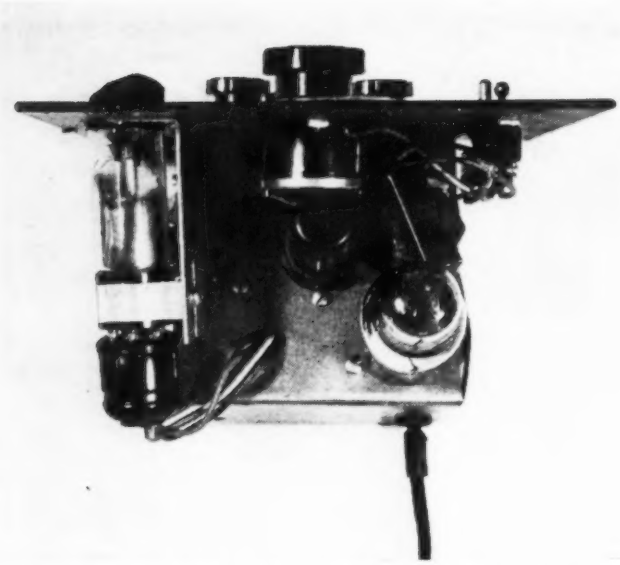
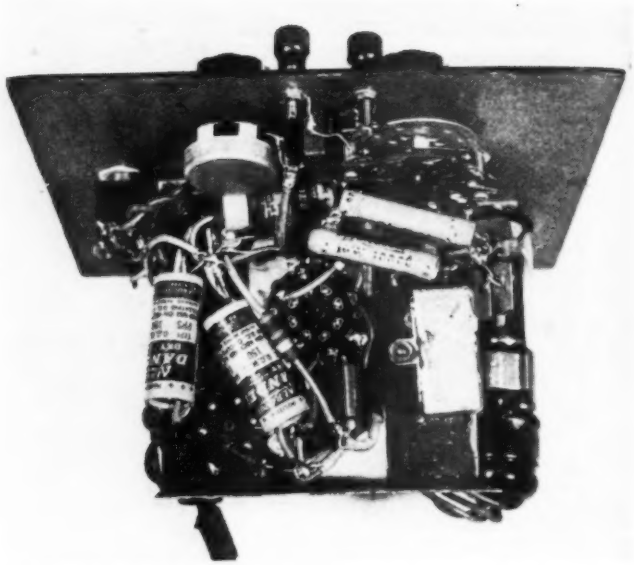


Above chassis view of RC Bridge. A linear taper potentiometer balances circuit for resistance and capacitance measurements.



Under chassis view shows placement of component parts. Direct point-to-point wiring is advisable in construction of unit.

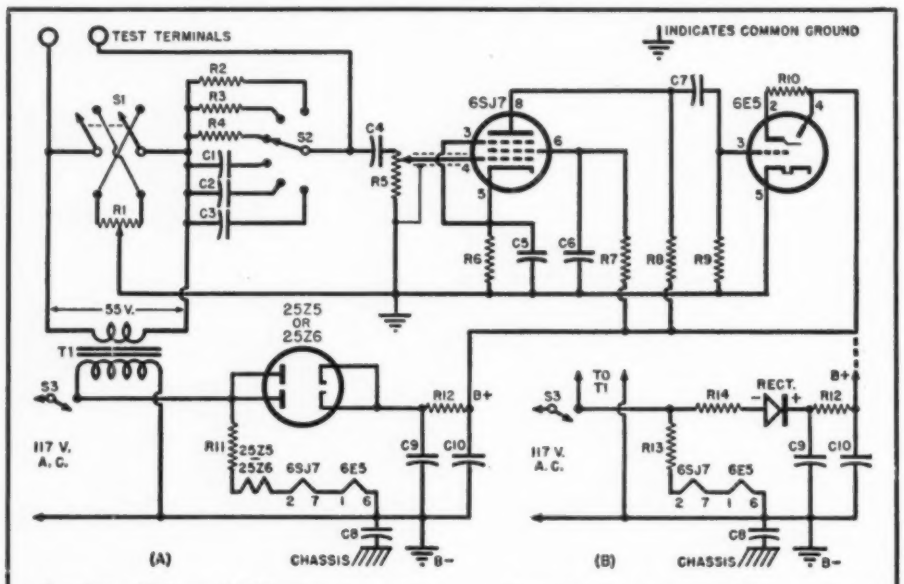
of capacity. The amplifier and null detector are used in the same manner as previously described for resistance measuring and the same dial calibration is used for both. Capacitance values fall in line due to the fact that equivalent values of standards and multipliers are used in both cases. In other words when the dial is calibrated for the middle resistance range (R x 1000) all of the other ranges, both capacity and resistance, will fall in line if the standards have been accurately picked for size.

The Main Circuit

Fig. 2 shows the circuit diagram as used for the wiring of the bridge. It will be seen that it is merely the completed form of Figs. 1A and 1B as previously described. An a.c.-d.c. type power supply is shown using a 25Z5 or 25Z6 as rectifier. The type 25Z5 was used since one was on hand but if the builder is using new parts probably a 25Z6 or a selenium rectifier would be preferable. The power supply using a selenium rectifier is shown in Fig. 2B and this would be substituted for the tube rectifier circuit. The proper line cord resistors are shown in each case as resistors R_{11} and R_{13}. The proper polarity of the selenium rectifier must be observed as indicated in Fig. 2B. The yellow lead is minus while the red lead is plus. Sufficient filtering is achieved by the use of the 1000 ohm resistor bypassed with the two 8 or 10 μfd. condensers since the current drain is very low. It is preferable not to connect the circuit ground to the chassis except through C_8, an .05 μfd. paper condenser. This condenser should be placed where the line cord enters the cabinet if a metal unit is used.

The bridge potential transformer T_1 is an audio type with a ratio of 2:1 or it may be a push-pull interstage type, 1:1 ratio, in which case one half of the secondary would be used. The desirable voltage is in the neighborhood of 55 volts since this provides for sufficient sensitivity. Higher voltage than this is not necessary or desirable due to shock hazard which, while not dangerous, is not recommended. The standard resistors R_2, R_3, and R_4 should be selected for greatest accuracy since upon them depend the accuracy of the bridge on resistance readings. If necessary, go through a batch of twenty or more at the radio supply store, checking them with a good ohmmeter for values nearest to those specified. The same procedure should be used for the condenser standards, C_1, C_2, and C_3, by means of a capacitance bridge. If no capacitance bridge is available it would be advisable to order these units special from the manufacturer, specifying the degree of accuracy required. At least 2% is recommended.

Fig. 2. Complete schematic diagram of RC Bridge. Inset (B) shows alternative power supply employing a selenium rectifier in place of conventional tube.



R_1—Pot., 3000 to 10,000 ohm 4 w., wirewound, linear taper, may be used.
R_2—10 ohm, ½ w. res.*
R_3—10,000 ohm, ½ w. res.*
R_4—1 megohm, ½ w. res.*
R_5—1 megohm pot.
R_6—3500 ohm, 1 w. res.
R_7—2 megohm, 1 w. res.
R_8—500,000 ohm, ½ w. res.
R_9, R_{10}—1 megohm, ½ w. res.
R_{11}—260 ohm, 25 w. line cord res.
R_{12}—1000 ohm, 1 w. res.
R_{13}—350 ohm, 35 w. line cord res.
R_{14}—20 ohm, 1 w. res.
C_1—100 μμfd., silver mica cond.*
C_2—.01 μfd., silver mica cond.*
C_3—1 μfd., oil filled bathtub type paper cond. (if exact value is not available, use lower value & pad with micas.)*
C_4, C_6, C_7—.01 μfd., mica cond.
C_5—10 μfd., 25 v. elec. cond.
C_8—.05 μfd., 400 v. cond.
C_9, C_{10}—8 or 10 μfd. @ 150 v. elec. cond.
Rect.—Selenium rectifier, 75 or 100 ma. type.
S_1—D.p.d.t. toggle sw.
S_2—S.p. 6 p. non-shorting rotary sw.
S_3—S.p.s.t. toggle sw.
T_1—Audio trans. 2 to 1 ratio (See text)
1—6SJ7 tube
1—6E5 tube
1—25Z5 or 25Z6 tube

** These components should be selected for exact values.*

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0-56VAC	0-32VDC	2Amp*	3.95
0-75VAC	0-43VDC	2Amp*	4.95
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.42	100	600	2600	9000
.5	105	612	2635	9445
.7	101	640	2700	9710
1.3	107	700	2860	10,000
1.75	113.1	733	2900	10,500
2	120	750	3000	12,000
3	121.2	800	3100	14,460*
4	125	900	3290	14,600
4.35	150	910	3384	15,000
5	160	1000	3500	15,000
5.025	165	1030	3730	17,000
6	170	1110	4000	17,000
7	182.4	1150	4300	18,000
7.5	200	1155	4440	19,000
7.8	209.4	1175	4444	20,000
7.9	230	1225	4500	20,520*
8	235	1250	4720	21,500
10	240	1260	4850	22,000
12	245.4	1322	4885	23,000
14.5	250	1350	4900	24,000
20	260	1500	5000	25,000
25	280	1510	5000	29,900
26	286	1600	5100	30,000
30	299	1640	5270	33,000
37	300	1650	5500	37,000
40	320	1800	5730	40,000
45	340	1830	6000	50,000
45.1	400	1865	6200	54,400*
49	418.8	1900	6300	60,000
50	426.9	2000	6500	65,000
55	440	2080	7000	68,000
56.7	452	2142	7500	75,000
60	480	2300	7700	80,000
71.4	487	2400	7950	84,000
75	500	2485	7950	90,000
80	520	2490	8000	91,000
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.1	.175	.254	.402	.62
.12	.185	.265	.422	.654
.13	.201	.268	.458	.7
.135	.22	.294	.478	.75
.14	.229	.314	.5	.7613
.14	.24	.33	.57	.8
.147	.245	.3335	.575	.9
.15	.25	.3535		.95
.15				

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1.2	2.855	4.23	9.05	12.83
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1.8	3.673			

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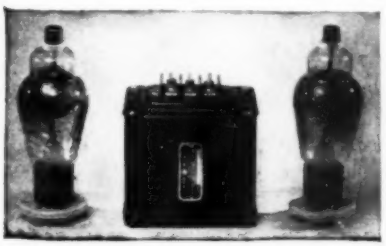

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2D21	.98	83V	1.25	3DP1	2.75
2X2	.49	OC3/VR-105	.74	3FP7	2.75
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3D6/1299	.95	304TL	6.95	5BP1	3.75
3S4	.98	307A	3.25	5BP4	3.75
5R4G	1.00	446A	1.98	5CP1	3.75
5T4	1.53	450TH	25.00	5FP7	3.95
5U4G	.69	450TL	29.95	5HP1	3.95
5W4	.98	WL531	18.00	7BP7/1813	3.95
5Y3G	.53	WL532	29.95	9JP1	3.95
5V4G	1.00	703A	4.95	12DP7	5.95
6Z3	.80	717A	.89	1B24	2.95
6Z4	1.00	723	2.95	1B27	2.95
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6AC7	.72	725	4.95	2E22	1.50
6AG5	.97	803	9.00	10Y	.35
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6B8G	.98	813	8.90	4E24/2527	10.00
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6J4	1.98	884	1.10	CE206	3.95
6J5	.72	922	1.49	FG104	14.95
6J6	.81	923	1.39	FG105	16.95
6J7	.88	931A	2.49	5D21	19.00
6K6GT	.74	954	.49	**TUNGAR***	
6K7	.78	955	.49	199698*	$2.95
6K8	1.20	956	.49	20X672*	2.95
6L6G	1.24	957	.49	289881*	2.50
6L7	1.16	958A	.49	**MAZDA PL****	
6N7	1.23	1613	.69	44** Box	$0.40
6S7	1.20	1616	2.75	47** Box	.50
6SA7G	.98	1619	.39	49** Box	.60
6SC7	.84	1622-6L6M	1.49	86** Box	1.40
6SN7	.91	1624	.79	**SOCKETS**	
6SQ7	.95	1625	.39	Acorn—6 for	$1.00
6SJ7	.79	1626	.45	866	.24
6SL7	1.00	1629	1.39	872/211	.49
6V6GT	.98	1635	1.00	803/304	.90
6X5	.87	1641	.84	813	.44
6Y6G	.88	2050	1.18	829/832	.25
7C5	1.00	2051	.88	807	.24
12A6	.29	7193	.49	705/715	.69
12AH7	1.00	8005	4.25	Maginal	.49
12K8	1.08	8012	3.95	Diheptal	.69
12SA7	.79	8013	3.95	2X2HV	.30
12SG7	.88	8016/1B3	2.00	**TUBES GTD except open Fil. & Breakage**	
12SH7	.88	8020	4.95		
12SK7	.88	9001	.49		
12SL7	1.08	9002	.59		
12SN7	.85	9003	.49		
12SQ7	.75	9004	.49		
12SR7	.81				
25Z5	.70				

KIT SILVER & MICA CONDSRS..50 for $ 2.00

KIT SILVER MICA CONDSRS....30 for 1.50

KIT CONTROLS 50-2MegAB/POTS 10 for 2.00

KIT VITREOUS WW RESISTORS..20 for 1.00

KIT SOCKETS (5-7-9-4P).....25 ASSTD 2.49

KIT POWER RHEOS. 25&50Watt....6 for 3.49

KIT ROTARY SWITCHES ASSTD..6 for 1.75

KIT G&P Tube Caps ⅛, ⅙, ¼"....50 for 1.49

KIT FUSES ASSTD BUSS&LF....100 for 1.95

KIT SPAGHETTI SLEEVING Asstd.75 for 1.00

KIT CERAMICON CONDSRS Asstd.15 for 1.00

KIT KNOBS Asstd with insert.....25 for 1.25

KIT MOTOR BRUSHES Asstd....100 for 1.00

KIT GROMMETS Rubber Radio Asstd. .....100 for 1.00

EXT CORD Hvy Duty/SJ/16'/M&Fplugs. .98

XTAL DIODE 1N34/@$1.49; 2 for $2.50 .....10 for 11.50

XTAL DIODE NEW 1N21, 1N23, THREE for.....2.00

X'DIODE 1N22, 1N23A, 1N25, 1N26, 1N27. 1.00

X'DIODE HOLDERS "TAB" DSGN .....FOUR for 1.00

"TAB" • NEW GUARANTEED • • Dept. 3RN, Six Church Street, New York 6, N.Y., U.S.A. CORNER CHURCH & LIBERTY STS., ROOM 200 • "TAB" • • ELECTRONIC PARTS

Of course it must be kept in mind that the cost of these special condensers is somewhat higher than for stock run units. When mounting these resistor and condenser standards they may be soldered right to the terminals of switch S_2 in order to provide short leads. This is essential in order to hold down the distributed capacity of the circuit and should be carefully adhered to in the bridge circuit proper. This partly accounts for the poor appearance of the under chassis wiring since all of it was done point-to-point. Keep the filament wiring as far as possible from the bridge circuit in order to avoid undesirable pickup. Grounded shield braid over the lead from the grid of the 6SJ7 to the arm of the potentiometer is recommended for the same reason.

Switch, S_1, is a double-pole, double-throw unit used as a reversing switch for the potentiometer, R_1. This must be wired so that the low values of resistance will fall at the left hand end of the dial. Then by reversing the potentiometer the low values of capacitance will also fall at this end of the dial. This is explained by the fact that the reactance of condensers varies inversely as their capacitance whereas the reactance of resistors varies directly with their resistance. It might be questioned as to why an additional switch was added here when the same thing might have been accomplished by use of a two deck switch. The reason is simply one of convenience in wiring since the average builder does not like to face a complicated switching, wiring arrangement. Also perhaps single deck switches might be more available in the junk-box.

The rest of the circuit is straightforward and should present no problems, even to the beginner. In the actual construction a small metal chassis that happened to be on hand was used to good advantage, but a wood or masonite chassis could have been used equally successfully. The layout of parts is shown in the chassis photo and worked fairly well but the builder may use his own discretion about the placement of components. A slanting panel arrangement was used and the cabinet which was made of masonite and wood was made to fit the slant that seemed most most convenient. Here the ideas of individual builders will vary but the slanting panel arrangement is to be recommended since it makes for the easiest reading of the magic eye.

Making and Calibrating the Dial

The calibration of the dial is the most exacting job in the building of the bridge and care should be taken here since the accuracy of the readings will depend largely on the accuracy of the dial calibration. After the wiring is completed and the bridge "fired up," that is, tested for lighting of filaments and correct operation of the magic eye by varying the gain control potentiometer, R_5, the dial is ready to be calibrated. Attach a piece

of tracing paper, somewhat larger than the finished dial, to the panel. This size will be determined by the type and size of pointer that is used but should be as large as possible to provide maximum reading accuracy. A homemade pointer was made by attaching a piece of lucite to a transmitter type knob and scratching an indicator line on it with a sharp instrument. This scratch was filled in with colored pencil. The tracing paper may be fastened to the panel by scotch tape but care should be taken not to move it after calibration is started. If a decade box is available it may be connected across the test terminals and set the range switch to "R x 1000." Now switch in 100 ohms and balance bridge for null by complete opening of the magic eye with the sensitivity control set for best control. If the null point is at right hand end of dial, throw reversing switch, S_1, to other side, then mark this point 0.1 on the tracing paper. As a guide it would be well to sketch the circular sweep of the pointer onto the tracing paper to aid in placing of figures and points.

Values of resistance should be employed from 100 ohms to as high as ten megohms, using enough values to get good points in the scale. This may be quite readily done if a series of decade boxes are available. If not you will have to resort to the method as recommended by Mr. Turner for his bridge and his listing of resistors is reprinted here. Perhaps you could borrow the resistors from your radio parts jobber, or as an alternative, buy them and use them for calibration and then return them for credit expecting to be charged something for their use. The following list of resistors is reprinted from the April issue of RADIO NEWS: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500, 7000, 7500, 8000, 8500, 9000, 9500, 10,000, 11,000 12,000, 13,000, 14,000, 15,000, 16,000, 17,000, 18,000, 19,000, 20,000, 25,000, 30,000, 35,000, 40,000, 45,000, 50,000, 55,000, 60,000, 65,000, 70,000, 75,000, 80,000, 85,000, 90,000, 95,000, 100,000, 150,000, 200,000, 250,000, 300,000, 400,000, 500,000, 1 megohm and 10 megohms. After these points have been marked on the tracing paper it is removed and the numbering is permanently applied with India ink. At the same time a title plate for the bridge and any other nameplates that are needed for identification may be drawn on tracing paper, such as the range switch plate, etc. If you are familiar with photographic processing you can use these tracing papers as positives in place of ordinary film negatives and make nameplates which present a commercial appearance. If you have no facilities for handling these take them to the nearest photo finisher and he will process them for a nominal sum. Tell him in detail just what is desired, in other words you want a solid black background with white letters. If you want to process them yourself use a high contrast pa-

per such as *Velox* F-4 although F-3 may be used with good results. You will find that a fairly short interval of exposure is necessary. The nameplates, when finished, may be mounted with *Duco* cement or *Cascamite* glue works well. Some experimenting may be necessary to achieve just the results you desire but the finished product when properly handled produces nameplates which compare favorably with commercially produced plates which will cost you many times the cost of these.

A few notes are in order for the operation of the bridge. If in checking a resistor or condenser no null point is found on any range but the eye opens on the right hand end of dial it indicates a resistance or capacitance too high to read or an open. If this occurs at the left hand end of dial it indicates a value too low to read or a short. If no null point is found at first switch to the next range, higher or lower as the case may be. This sounds a bit difficult at first but you will rapidly become used to the operation and it is really quite simple.

Due to the lack of any voltage control on the bridge some change in calibration due to fluctuations in line voltage was anticipated. This did not prove to be the case, however, as was proven by powering the bridge through an autotransformer. The bridge was adjusted for null at some particular value with the sensitivity control turned up as far as possible. The line voltage was then varied from 85 volts to 125 volts and no change in the opening of the eye was noted. The brilliance of the eye changed, as was to be expected, and this would indicate a variation in sensitivity but no change in calibration was noted. This, of course, is a very desirable feature since no compensation for line voltages is necessary.

This bridge should prove to be desirable to the experimenter and beginner since it offers, for a nominal layout in parts and labor, an instrument capable of fairly precise measurement of capacitance and resistance, the degree of accuracy depending upon the workmanship and quality of parts used. Its simplicity is its main virtue and it should indicate to the beginner that it is possible to build good instruments at home with only limited facilities. —30—

"Yes—our radio is on but I'm listening to my wife!"

International Short-Wave

(*Continued from page* 109)

17.720—LRA5, Buenos Aires, Argentina, "Radio del Estado," 5 kw.
***17.730**—GVQ, London, 50-100 kw.
***17.732**—OTC5, Leopoldville, Belgian Congo, 50 kw.
17.740—Moscow.
17.745—OTC5, Leopoldville, Belgian Congo, "Radio Nationale Belge," 50 kw.
***17.745**—OTM6, Leopoldville, Belgian Congo, "Radio Congo Belge," 20 kw.
17.750—OZI, Skamlebak (Copenhagen), Denmark, 6 kw.
17.750—WRUW, Boston, Mass., U.S.A., 20 kw.
17.750—Moscow.
***17.755**—ZBW5, Hong Kong, China, 2.5 kw.
17.755—LKW, Oslo, Norway, 5 kw.
#17.755—XGSS, Nanking, China.
17.760—VUD3, Delhi, AIR, 5 kw.
***17.760**—VUD8, Delhi, AIR, 7.5 kw.
***17.760**—KWID, San Francisco, Calif., U.S.A., 100 kw.
17.760—KWIX, San Francisco, Calif., U.S.A., 50 kw.
***17.760**—KUIM, Tokyo.
17.765—Paris, "Radiodiffusion Francaise," 100 kw.
***17.770**—OTC5, Leopoldville, Belgian Congo, "Radio Nationale Belge," 50 kw.
17.770—Colombo, Ceylon, "Radio SEAC," 7.5 kw.
***17.770**—ZL5, Wellington, New Zealand, 10 kw.
***17.770**—Malacca, Malaya.
***17.770**—HED8, Berne, Switzerland, 25 kw.
***17.770**—KNBA, Dixon, Calif., U.S.A., 50 kw.
17.770—Moscow; to North America, 0745-0815.
#17.770—Horby, Sweden.
***17.775**—PJC1, Willemstad, Curacao, "Radio Princess Juliana," 3 kw.
***17.775**—HEU3, Berne, Switzerland, "Swiss Broadcasting Corp." 25 kw.
***17.775**—Colombo, Ceylon.
17.776—PHI, Hilversum (Huizen), Holland (Netherlands), "Radio Nederland," 5 kw.
***17.780**—KCBR, Delano, Calif., U.S.A., 200 kw.
***17.780**—KNBA, Dixon, Calif., U.S.A., 50 kw.
***17.780**—KGEX, San Francisco, Calif., U.S.A., 100 kw.
17.780—WNBI, New York, N.Y., U.S.A., 50 kw.
17.784—HER7, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
17.785—LKX, Oslo, Norway, "Radio Oslo," 5 kw.
***17.785**—JZL, Tokyo.
#17.785—XGST, Nanking, China.
17.790—GSG, London, 50-100 kw.
***17.795**—HEI8, Berne, Switzerland, "Swiss Broadcasting Corp., 25 kw.
***17.795**—JLU4, Tokyo.
17.798—OIX5, Lahti (Helsinki), Finland, 1 kw.
17.800—VLA7, Shepparton, Australia, "Radio Australia," 100 kw.
***17.800**—VLB7, Shepparton, Australia, "Radio Australia," 100 kw.
***17.800**—XGOY, Chungking, China, 35 kw.
***17.800**—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
***17.800**—KRHO, Honolulu, Hawaii, 100 kw.
17.800—WLWK, Cincinnati, Ohio, U.S.A., 50 kw.
17.800—WLWO, Cincinnati, Ohio, U.S.A., 75 kw.
#17.800—Manila, Philippines.
17.805—LLP, Oslo, Norway, "Radio Oslo," 5 kw.
17.810—GSV, London, 50-100 kw.
#17.812—Rabat, French Morocco.
***17.815**—HNI, Baghdad, Iraq, 5 kw.
***17.815**—XUPA (now XURA), Tai-Pei, Formosa.
17.820—CKNC, Sackville, Canada, "CBC International Service," 50 kw.
17.820—Singapore, Malaya.
17.820—Colombo, Ceylon, "Radio SEAC."
***17.820**—COBZ, Havana, Cuba, 1 kw.
***17.820**—XEHH, Mexico City, Mexico, 250 w.
***17.820**—Moscow.
***17.820**—IRU, Rome, Italy.
17.825—LLN, Fredrikstad, Norway, "Radio Oslo," 5 kw.
***17.825**—Khabarovsk, U.S.S.R.
***17.830**—LRA5, Buenos Aires, Argentina, 5 kw.
***17.830**—OLR6A, Prague, Czechoslovakia, 30 kw.
17.830—VUD10, Delhi, AIR, 20 kw.
17.830—WCBX, New York, N.Y., U.S.A., 50 kw.
17.835—JVU3, Yamata, Japan, 2 kw. and 40 kw.
***17.835**—JLP3 and JVW5, Tokyo.
#17.835—XGSU, Nanking, China.
17.838—Kiev, U.S.S.R., 40 kw.
***17.840**—VLA10, Shepparton, Austria, "Radio Australia," 100 kw.
17.840—VLC9, Shepparton, Australia, "Radio Australia," 50 kw.
17.840—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
17.840—Athlone, Ireland, "Radio Eirrean," 1.5 kw.
***17.840**—HVJ, Vatican City, Vatican, "Radio Vaticano," 25 kw.
#17.840—XGSV, Nanking, China.
***17.840**—JLS2, Tokyo.
17.840—JAG, Osaka, Japan.
#17.840—Horby, Sweden.
17.845—Brazzaville, French Equatorial Africa, "Poste Nationale Francaise," 800 w.

WE'RE CLEANING THE SLATE FOR '48!

Mort's nuts . . . we're all nuts. Take advantage of our condition . . . we're all slaphappy—which is to your good. Everything begins new and fresh in 1948. A clean sweep . . . bring your own broom, truck, or what have you. Carry away the whole joint . . . and at the following prices, you can do it. Kiddin' aside, you'll find wonderful bargains in stuff you can always use. Wipe the slate clean so that we can serve you better in '48.

WRITE, WIRE, PHONE OR CRAWL IN ON YOUR KNEES . . . WE FILL ALL ORDERS IMMEDIATELY . . . IT'S LOTS OF FUN

WE'RE CRAZY, but you'd be crazier if you bought these 72 ohm twisted rubber pair and 300 ohm ribbon line standard brand wire if you paid more than our price of 100 feet for **$2.95** . . . per 1000 ft. **$27.50**

OUR CAPACITY IS REACHED . . . must trim our shelves . . . Air Trimmers 1" shaft. 140 MMF for HF & VHF. Trim with our trimming . . . General padding, etc. Isolantite base . . . **39c** ea. 10 for **$3.50**

"FALL IN" . . . we sure did. Ever get stuck for a hundred grand? Army Surplus Output Meter "146." Can be used as AC Voltmeter as well as output meter. No hot stove range, but ranges 1½-6-15-60-150 volts . . . meter is 4000 ohms . . . completely baked in bakelite case with test leads. Steal 'em for **$10.49**

WATCH YOUR WIFE? BABIES? GIRL-FRIEND? . . . Put "Ultra Mike" on guard. No wires, connects to blab box . . . a terrific steal with batteries, tubes, and what have you. Super special . . . **$6.63.** Retail $18.00. F.O.B. Chicago.

WE WERE TALKED INTO these Four Tube Amplifiers . . . don't let yourself be fooled too. They're 110 volt AC, 60 Cy. A classy chassis . . . all wired and ready to go. Less tubes. . . . Only a jerk would buy 'em for $29.95 ea. when you can buy 'em for **$12.95 ea.**

THE BOSS SURE GOT TAKEN when he bought these Three Tube Amplifiers at $15.50 . . . they're 110 volts, AC, 60 Cy. . . . complete, less tubes. We're giving 'em away at **$10.95**

DON'T FALL OFF THE ROOF . . . we went off the deep end buying these RCA Television and FM Antennas . . . Di-pole and Reflector . . . now we're climbing back on the roof and putting these items up for sale at **$8.55** ea.

IDEAL FOR HANGING . . . that's what we ought to do to the guy who made up these Antenna Kits . . . this pile of scrap has 50' of (hanging strength) copper stranded wire and 50' of rubber lead-in wire. Insulators, nail knobs, etc. With our fingers crossed . . . **69c** per kit.

ATTENTION! ABOUT FACE . . . and start running . . . because if you want a Signal Generator from Army Surplus, you'd better get here fast. No. 1-22-a . . . from 8 Mc to 230 Mc. Crystal Calibrated 117 Volt, 60 Cycle self contained power supply. We even furnish the tubes. Lower your sights . . . these generators are within the ranges of intermediate freqs. for FM and Television Sets. Carry 'em away with you for **$45.95 ea.**

WE CAN DREAM, CAN'T WE? . . . this Army Surplus in the form of a Power Transformer . . . 175 Ma. . . . 515-0-515 Volts, 5V at 3 Amps. 2½V Ct. 5 amps. had us up in the clouds until we found out that our boss wanted us to sell them. They'll do for small transmitters and amplifiers. Used to be a good black market item . . . now you can have 'em for **$4.95**

WEBSTER MODEL 79 WIRE RECORDER foundation unit. Formerly retailed at **$90.** This is the first time that this quality product has ever been offered to the trade at less than $52.92 . . . new low price of **$44.10**

JUMPIN' JEHOSEPHAT . . . Some more Army Surplus! For all the Sparky boys . . . Standard Hand Telegraph Keys . . . can't go wrong at **69c**

WE'RE LYING WHEN WE SAY that these Bakelite House Pickup Arms were actually worth $3.51 ea. They're standard and lightweight . . . but we're not lying at . . . **$1.79 ea.**

NEED SOME PILOT LIGHT BULBS? We sure don't . . . some stupid oaf bought a train load of standard branded #13, #14, #40, #44, #46, #47, #50, #51 bulbs. Standard boxed—10 to carton. Crazy is as crazy does . . . yours per 100 . . . **$5.00**

HOW TO GET INTO A TIGHT SPOT . . . Use one Pilot Light Installer . . . a handy gadget for inserting . . . lights . . . in tight places . . . **24c** ea.

WE RAISE OUR RIGHT HANDS when saying this . . . never in our checkered career have we found such a lovely group of hard to move Heavy Duty Phillips Screw Drivers #2 size . . . and for #10 to 16 screws . . . we were robbed for 82c ea. . . . you can have 'em at **49c** ea.

DEEP IN OUR DARK BASEMENT we came upon these Condensers. Standard 20x20 Mfd. 150V. Tubulars. We can't sell 'em, so we'll give 'em to you at **39c** ea. or 10 for **$3.50**

HAVE YOU CONVERTED TO MORT'S . . . Hmmmmm! We wouldn't switch to these Meck FM Converters (88 to 108 MC) either if the price was $59.95 ea., even though they'll attach to any standard AM radio. They come in a Bakelite cabinet. You're not taking a chance at **$15.95 ea.** A big deal at 3 for **$44.85**

WE CLAIM THEY'RE WORTH $40.00. but any darned fool would know that these Precision Resistor Kits aren't worth more than 10 for **$1.79** . . . (plus or minus 1% standard brand).

SUPER OUTPUT TRANSFORMERS, we're nuts, but they are for 50L6, 25L6 . . . you can't use them, even though they're for standard 4, 5 and 6 inch speakers. Don't even look at 'em for 79c each. How about **54c** each . . . oh well! 10 for **$4.90** or we throw 'em away.

NOW HEAR THIS . . . the newest, the latest super-duper, Superhet Radio with Five Jumpin, jiving tubes, AC DC. Terrific cabinet can be used for a foot rest . . . a gift at **$16.95** ea. A triple gift at 3 for **$47.50**

CAN CONDENSERS THE SCREW TYPE WAY . . . if you can use some more junk, these are 35x35x35 mfd. at 150V . . . sweeping them out the door at **89c** ea. or 10 for **$7.90**

NOISE, NOISE, NOISE . . . filter same if shaving with an electric razor . . . radio noise filters for Filtering Line Noises. Glad to get rid of 'em at . . . **$1.14**

WE'RE PRACTICALLY GIVING AWAY these Resistor Kits. Unlucky purchase by some dumb schmoe means 100 asst. Resistors ¼, ½ and 1 watt at 10%. Resistors for next to nothing. Super deal at **$1.89** per kit.

THAT BOSS OF OURS expects us to sell these brand new Volume Controls with Switch Half Meg 2½ inch shafts for $1.17 ea. . . . now you know we expect you to buy them at **49c** ea. or 10 for **$4.40**

NO ONE WANTS 'EM at 32c each, so we're condensing a bunch of 20 Mfd. 150V Condensers into 10 for **$1.49**

THESE HEAVY DUTY 4" PM Speakers with output for 50L6, 25L6, etc. . . . make sound come out like your old first sergeant's voice . . . you can have 'em, we don't want 'em . . . for **$1.79 ea.**

MORT BOUGHT 'EM AND WE'RE STUCK . . . sneaked these Standard 5" PM Speakers . . . Alnico V. Magnet, out the back way . . . take 'em out under your coat for **$1.45 ea.**

WE'RE SURE NOT PROUD OF THESE Metal Speaker Cabinets . . . don't know what you can do with 'em, but they will house a 6" Speaker and small Amplifier. Not worth $3.75 ea. But you can't go wrong at **$1.25 ea.**

NOT JESS WILLARD THE FIGHTER . . . but Willard 2-volt Storage Battery . . . a fighter nevertheless. Comes in a snazzy plastic case. Shipped dry . . . spill proof. 5⅛" high, 3⅛"x2⅜". . . . Was $6.00. The Winnah at **$1.95**

SHOCKING! Bare nekked Copper Stranded Antenna Wire in 50' or 100' rolls . . . 50' for **28c** 100' for **34c**

IN OUR JUNK HEAP we found some new Auto Radio Antennas that we can't even give away for $2.15 ea. . . . maybe if we paid you to take them you could use same for flag poles . . . anyhow, they come in 3 sections and fit the side cowl. Carry 'em away for **97c** ea.

HOLD ON TO YOUR UPPERS . . . we lost our eye-teeth when we bought these Antennas at $2.75 . . . but because they're brass with chrome plating . . . in 3 sections, and rustproof, with side cowl mounting, you can take advantage of our stupidity for **$1.75 ea.**

MAYBE YOU CAN USE THESE American Beauty Soldering Elements . . . we certainly can't . . . the boss says "give 'em away," but since they're 100 watt, and take a ⅜" tip . . . you can have all you want for **$1.85 ea.**

WE FINALLY DUG THESE UP. Standard Sets IF Coils 2⅛"x1¼" genuine prewar quality . . . they listed for **$3.00,** but don't let that fool you . . . they're only worth **69c** per set . . . 456 Kc.

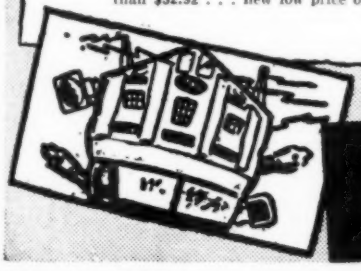
WE'VE TRIED TO SHOVEL these Army Surplus Utah High Impedance Earphones out the door, but they won't move . . . come in and grab a handful at **$1.79 ea.**

ARE YA LISTENIN' . . . Hmmmmm!—Microphone Floor Stands for use as hat racks . . . the durable chrome finish isn't durable and the heavy black crackle base has cracked all over the place . . . but for a hat rack they'll do . . . as a mike stand they were worth $9.95 . . . as a hat rack . . . **$4.75**

USE IT FOR AN OVERNIGHT CASE . . . A Portable Record Changer Case with inside dimensions on changer base 13"x15" with 9" depth. Will take 6" speaker. Ideal for those little intimate things . . . was $12.95 . . . record change to **$5.95**

CHECK YOUR INLAYS AND RELAYS . . . we're crazy and you will be too if you buy 10 of these assorted relays for $25.00 when Mort's giving them away at **$2.49**

Write for our new, FREE 1948 Catalog . . . Terms: 25% Deposit with order . . . Balance C.O.D.

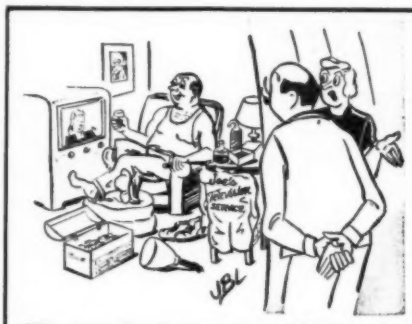


Mort's Radio Shack

630 W. RANDOLPH STREET — CHICAGO 6, ILL.

*17.850—PRL9, Rio de Janeiro, Brazil, "Radio Nacional," 50 kw.
*17.850—COBC, Havana, Cuba, 1 kw.
17.850—Paris, "Radiodiffusion Francaise," 100 kw.
*17.850—KCBF, Delano, Calif., U.S.A., 50 kw.
*17.850—KNBI, Dixon, Calif., U.S.A., 50 kw.
#17.850—HHK, Leogane, Haiti.
*17.855V—Paris, "Radiodiffusion Francaise," 25 kw.
*17.860—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
17.860—Moscow.
17.880—KGEX, San Francisco, Calif., U.S.A., 100 kw.
17.880—WGEX, Schenectady, N.Y., U.S.A.
*17.915—CR7BI, Lourenco Marques, Mozambique, "Radio Mozambique," 10 kw.
17.975—ZNX, St. Georges, Bermuda.
17.980—KQZ, Bolinas, Calif., U.S.A.
18.025—GRQ, London, 50-100 kw.
18.035—ICJ, Rome, Italy.
18.070—PCV, Kootwijk, Netherlands.
18.073—PGD, Kootwijk, Netherlands.
18.080—GVO, London, 50-100 kw.
18.115—LSD9, Buenos Aires, Argentina, 8 kw.
18.130—GRP, London, 50-100 kw.
18.135—PMC, Batavia, Java, "Radio Batavia," 3 kw.
18.160—WNRI, New York, U.S.A., 50 kw.
18.170—Moscow.
18.330—Paris, France.
18.388—FZS, Saigon, French Indo-China, "Radio Saigon."
*18.452—HBF, Geneva, Switzerland, 20 kw.
*18.480—HBH, Geneva, Switzerland, 20 kw.
18.600—PLA, Batavia, Java, "Radio Batavia," 2.5 kw.
18.750—F3A, Hong Kong.
18.910—JVA, Tokyo.
*19.046—Johannesburg, South Africa (Johannesburg III), 5 kw.
19.055—Bridgetown, Barbados.
19.080—GYBS, Royal Observatory (Greenwich).
19.330—IFV, Rome, Italy.
19.345—PMA, Batavia, Java, "Radio Batavia," 2.5 kw.
19.355—FTM, Paris, 30 kw.
19.400—LQB5, Buenos Aires, Argentina, 1 kw.
19.450—XGN5, Shanghai, China.
*19.554—HEO6, Berne, Switzerland, 25 kw.
*19.565—HEK6, Berne, Switzerland, 25 kw.
19.660—SUS, Cairo, Egypt, 2 kw.
19.764—SUP3, Cairo, Egypt, 10 kw.
20.000—WWV, Washington, D.C., U.S.A., Bureau of Standards, 8.5 kw.
*20.040—OPL, Leopoldville, Belgian Congo, "Radio Congo Belge," 7 kw.
*20.050—Cairo, Egypt.
20.148—SUP, Cairo, Egypt, 10 kw.
21.002—Brazzaville, French Equatorial Africa, "Post Nationale Francaise."
*21.181—Brazzaville, French Equatorial Africa.
*21.220—Moscow.
*21.350—Moscow.
*21.450—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
*21.450—OLR7A, Prague, Czechoslovakia, 30 kw.
#21.450—XGSW, Nanking, China.
*21.460—LKY, Oslo, Norway, "Radio Oslo," 5 kw.
*21.460—KCBF, Delano, Calif., U.S.A., 50 kw.
21.460—KNBA, Dixon, Calif., U.S.A., 50 kw.
*21.460—WRU?, Boston, Mass., U.S.A., 50 kw.
*21.470—Colombo, Ceylon, "Radio SEAC," 7.5 kw.
21.470—GSH, London, 50-100 kw.
*21.480—PHI, Hilversum (Huizen), Holland (Netherlands), "Radio Nederland," 5 kw.
*21.490—Paris, "Radiodiffusion Francaise."
*21.490—KGEI, San Francisco, Calif., U.S.A., 50 kw.
*21.500—LKZ, Oslo, Norway, 5 kw.
#21.500—HHK, Leogane, Haiti.
21.500—WOOW, New York, N.Y., U.S.A., 50 kw.
*21.500—WGEA, Schenectady, N.Y., U.S.A., 50 kw.
*21.505—Moscow.
21.510—VUD8, Delhi, AIR, 7.5 kw.
*21.510—Rome, Italy.
#21.510—XGSX, Nanking, China.
*21.520—HER8, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*21.520—New York, N.Y., U.S.A., 50 kw.
*21.520—JZM, Tokyo, Japan.
21.530—GSJ, London, 50-100 kw.
*21.540—VLR5, Melbourne, Australia, "A.I.C.," 2 kw.
21.540—VLB5, Shepparton, Australia, "Radio Australia," 100 kw.
*21.540—WBOS, Boston, Mass., U.S.A., 50 kw.
*21.540—Brussels, Belgium.
21.550—GST, London, 50-100 kw.
*21.550—OIX6, Lahti (Helsinki), Finland, 7 kw.
#21.550—XGSY, Nanking, China.
*21.560—Moscow.
*21.560—JLP4, Tokyo.
*21.565—OLR7B, Prague, Czechoslovakia, 30 kw.
21.570—WCRC, New York, N.Y., U.S.A., 50 kw.
*21.565—OLR7B, Prague, Czechoslovakia, 30 kw.
21.570—WCRC, New York, N.Y., U.S.A., 50 kw.
*21.580—Paris, "Radiodiffusion Francaise."
*21.580—Horby, Sweden, 100 kw.
21.590—WGEA, Schenectady, N.Y., U.S.A., 50 kw.
*21.600—VLA9, Shepparton, Australia, "Radio Australia," 100 kw.
*21.600—VLB8, Shepparton, Australia, "Radio Australia," 100 kw.

*21.605—HEI9, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*21.610—KNBA, Dixon, Calif., U.S.A., 50 kw.
21.610—WNRA, New York, N.Y., U.S.A., 50 kw.
*21.610—JLT4, Tokyo.
*21.618—Colombo, Ceylon.
*21.620—COCY, Havana, Cuba, "RHC-Cadena Azul," 1 kw.
*21.620—Paris.
*21.620—Colombo, Ceylon, "Radio SEAC," 100 kw.
*21.620—JLS3, Tokyo.
‡21.620—XGSZ, Nanking, China.
*21.625—OZX2, Skamlebak (Copenhagen), Denmark, 6 kw.
*21.630—KNBA, Dixon, Calif., U.S.A., 50 kw.
*21.630—New York, N.Y., U.S.A., 50 kw.
*21.640—OLR7C, Prague, Czechoslovakia, 30 kw.
21.640—GRZ, London, 50-100 kw.
*21.650—WLWL, Cincinnati, Ohio, U.S.A., 75 kw.
21.650—WLWS, Cincinnati, Ohio, U.S.A., 75 kw.
*21.670—LLP, Oslo, Norway, "Radio Oslo," 5 kw.
‡21.670—HHK, Leogane, Haiti.
21.675—GVR, London, 50-100 kw.
21.680—VLC10, Shepparton, Australia, "Radio Australia," 50 kw.
*21.680—OTC6, Leopoldville, Belgian Congo, "Radio Nationale Belge," 50 kw.
21.680—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
‡21.690—Horby, Sweden, 100 kw.
21.690—WLWL1, Cincinnati, Ohio, U.S.A., 75 kw.
*21.705—HEU9, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*21.710—CHLA, Sackville, Canada, "CBC International Service," 50 kw.
*21.710—OZX, Skamlebak (Copenhagen), Denmark, 6 kw.
21.710—GVS, London, 50-100 kw.
*21.715—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
‡21.720—Horby, Sweden, 100 kw.
*21.720—Motala (Stockholm), Sweden, 12 kw.
21.720—Singapore, Malaya, "The British Far Eastern Broadcasting Service."
*21.730—LLQ, Oslo, Norway, "Radio Oslo," 5 kw.
21.730—WNRX, New York, N.Y., U.S.A., 50 kw.
*21.740—COCW, Havana, Cuba, "Cadena Azul," 1 kw.
*21.740—Paris, "Radiodiffusion Francaise," 100 kw.
21.750—GVT, London, 50-100 kw.
*22.004—ZLO, Waiouru, New Zealand, 10 kw.
22.225—Ronne Antarctic Expedition.
25.000—WWV, Washington, D.C., U.S.A., Bureau of Standards, 100 w.
25.600—WRUX, Boston, Mass., U.S.A.
*25.610—HER9, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*25.750—GSQ, London, 50-100 kw.
25.800—TFJ, Reykjavik, Iceland.
*25.800—ZL6, Wellington, New Zealand, 7.5 kw.
*25.900—LLA, Oslo, Norway, "Radio Oslo," 5 kw.
*26.020—HED9, Berne, Switzerland, "Swiss Broadcasting Corp.," 25 kw.
*26.020—HVJ, Vatican City, Vatican, "Radio Vaticano," 15 kw.
*26.070—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
26.100—GSK, London, 50-100 kw.
*26.125—TGWA, Guatemala City, Guatemala.
*26.200—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
*26.350—LLC, Oslo, Norway, "Radio Oslo," 5 kw.
*26.400—GSR, London, 50-100 kw.
*26.470—Brussels, Belgium, "Radio Nationale Belge," 5 kw.
*26.520—TGWA, Guatemala City, Guatemala, "La Voz de Guatemala," 10 kw.
26.550—GSS, London, 50-100 kw.
‡27.000—CXA11, Montevideo, Uruguay, "Radio Electrica," 2.5 kw.
‡29.500—CXA22, Montevideo, Uruguay, "Radio Electrica," 2.5 kw.
30.000—WWV, Washington, D.C., U.S.A., Bureau of Standards, 100 w.
35.000—WWV, Washington, D.C., U.S.A., Bureau of Standards, 100 w.
(NOTE: Compiled to December 15, 1947.)



"He says he has to wait till the programs are over so he can check the signal pattern!"

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

RESISTOR CATALOGUE

Resistance Products Company of Harrisburg, Pa., has just issued a new catalogue sheet covering its "B" type high voltage resistors.

Included is data covering dimensions, suggested mounting, ambient temperature graphs, engineering specifications, construction details, power rating figures, resistance tolerance, etc.

A copy of this publication can be secured by writing to *Resistance Products Company,* 714 Race Street, Harrisburg, Pa.

MINI-SIGNAL GENERATOR

Complete details and specifications covering the new Model 117 Crystal Controlled High Frequency Mini-Signal Generator are given in a four-page technical bulletin just issued by *Premier Crystal Laboratories, Inc.*

A complete circuit diagram and specific instructions for zero-beating the crystal by means of a unique micrometer adjustment are special features of the bulletin. Various uses for the signal generator in the aligning of AM, FM, and television receivers, as well as for testing amateur and mobile communications equipment are also suggested by the booklet.

Copies of the publication may be obtained by writing *Premier Crystal Laboratories, Inc.,* 53-63 Park Row, New York 7, New York.

KNOB CATALOGUE

Rogan Brothers have announced the availability of a new illustrated catalogue which lists specifications for their complete line of stock molded plastic knobs, control handles, instrument knobs, etc.

The booklet also contains useful engineering data to be used by design personnel. Copies of the catalogue may be obtained by writing to *Rogan Brothers,* 2500 W. Irving Park Boulevard, Chicago 18, Illinois.

TIMING UNITS

A 2-color, 16-page catalogue covering synchronous timing motors, timing devices, and clock movements has just been released by *Haydon Manufacturing Company, Inc.,* of Torrington, Connecticut.

The new catalogue is complete and includes photographs, profile drawings, shaft drawings, and complete listings of the speeds, voltages, frequencies, shaft sizes, and all other standard or special variations available in each motor listed.

The catalogue also lists many additional features for specific timing operations, such as shift mechanism for automatic resetting, frictions for manual resetting, and brake unit for instant stop.

The booklet is divided into separate sections of data sheets for each of nine different motor series manufactured, and for the various types of timing devices, such as repeat cycle and reset timers, time delay relays, interval timers, elapsed time indicators, etc.

Purchasing agents, engineers, and designers dealing with timing problems are invited to write for a copy of the catalogue. Address requests to E. B. Hamlin, *Haydon Manufacturing Company, Inc.,* Torrington, Connecticut.

SPEAKER CATALOGUE

The Magnavox Company of Fort Wayne, Indiana, has announced the compilation of a comprehensive loudspeaker catalogue covering all current *Magnavox* loudspeaker models from the 4" x 6" elliptical to the 15" size.

Pertinent engineering data covering both the electro-dynamic and magneto-dynamic versions of all models is included, along with illustrations and schematic diagrams.

Copies of the new catalogue are available to any instrument manufacturer, engineer, or purchasing agent. Make your request on company letterhead direct to *The Magnavox Company,* Fort Wayne Indiana.

POWER SUPPLIES

The Superior Electric Company of Bristol, Connecticut, is currently offering a pamphlet describing the new "Voltbox" a.c. power supplies manufactured by the company.

Details on the "Voltbox," along with specifications, are included. The folder also gives details on the company's "Voltbase," a unit available for users who already have the company's "Powerstat" variable transformer, type 116 or 216, but require the features of the new "Voltboxes."

A copy of this pamphlet, entitled "Portable Packaged Power," will be forwarded to those requesting it from *The Superior Electric Company,* Bristol, Connecticut.

FM SERVICING BOOKLET

The *Specialty Division* of *General Electric Company* has just published a 28-page booklet entitled "Visual Alignment Techniques for FM Servicing" which should be of interest to all servicemen.

Written by Jack Najork of the Measurement Engineering Section of

ANTENNA RELAY UNIT
0-10 Meter Weston Thermo-couple unit with 50 MMF, 5000v Vacuum condenser, and heavy duty relay... **$1.98**

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.5 mc to 150 mc
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up to 18v A.C.	up to	12v D.C.	30 Amp.	14.95
up to 36v A.C.	up to	28v D.C.	1 Amp.	3.45
up to 36v A.C.	up to	28v D.C.	5 Amp.	7.45
up to 36v A.C.	up to	28v D.C.	10 Amp.	12.45
up to 36v A.C.	up to	28v D.C.	15 Amp.	18.95
up to 54v A.C.	up to	36v D.C.	.25 Amp.	.98
up to 115v A.C.	up to	100v D.C.	.25 Amp.	2.95
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up to 115v A.C.	up to	100v D.C.	5 Amp.	19.95

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8mfd.	600v	1.10	15mfd.	2000v	4.95
10mfd.	600 v	1.15	.1mfd.	2500 v	1.25
1mfd.	1000v	.60	.25mfd.	2500v	1.45
2mfd.	1000v	.70	.5mfd.	2500v	1.75
4mfd.	1000v	.95	.05mfd.	3000v	1.95
8mfd.	1000v	1.95	.1mfd.	3000v	2.25
10mfd.	1000v	2.10	.25mfd.	3000v	2.65
15mfd.	1000v	2.25	.5mfd.	3000v	2.85
20mfd.	1000v	2.95	1mfd.	3000v	3.50
24mfd.	1500v	6.95	12mfd.	3000v	6.95
.25mfd.	2000v	1.05	2mfd.	4000v	5.95
.5mfd.	2000v	1.15	1mfd.	5000v	4.95
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SPECIAL 2 mfd. 3000v					$4.45

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Used but in perfect condition. Two stages RF, separate local and beat oscillators. For 12-volt DC operation but easily converted to 110-volt AC. Frequency range 150-1500 KC, continuous in 6 bands. This unit is ideal as an airport or marine low frequency receiver, also a very excellent BC receiver. Complete with tubes, specially priced at..... **$29.50**

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Operates from 200 kc—12.5 mc complete with all tubes, dynamotor, seven tuning units and one antenna tuning unit.
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Constant Voltage Transformer
Pri.: 190 to 260v 60 cyc.
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for CATHODE RAY TUBES
3" Shield..... $1.49
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2C40	1.19	703A	7.95
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2V3G	1.25	721A	4.35
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3AP1	3.00	801	1.49
3BP1	2.95	802	1.98
3E29	2.95	803	8.95
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5BP4	4.95	805	4.95
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6AB7	.99	811	1.95
6AC7	.99	812	3.15
6AG5	.99	813	8.95
6AG7	.99	814	4.45
6AJ5	.99	815	3.95
6AK5	.98	829-A-B	3.00
6AL5	.99	832	2.25
6AQ6	1.09	833A	39.50
6AR6	1.29	836	1.75
6B4G	1.29	837	2.50
6C4	.69	838	3.95
6C5	.49	861	69.50
6D4	.99	866	.75
6F6	.89	872A	2.50
6F6G	.59	884	.98
6J4	1.50	885	.98
6J5	.55	902	3.00
6J6	.89	954	.75
6L6	1.23	955	.75
6L7	.98	956	.75
6N7	1.02	957	.75
6SH7	.59	958	.75
6SL7	.89	959	.75
6SN7	.69	1005	.69
6SR7	.89	1616	2.95
7A4	.81	1619	.75
7F7	1.25	1620	1.98
7L7	1.59	1622	1.98
10Y	.98	1624	.90
15E	1.50	1625	.75
HK24G	1.75	1626	.75
28D7	.98	8001	6.49
30	.75	8003	9.95
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F-127A	22.50	F-128A	75.00

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Glide Path Receiver used in the Instrument Landing Sytem covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6AJ5, 1—12SR7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522K.
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12 hy @ 100ma	1.39	15 hy @ 100ma	1.39
30 hy @ 70ma	1.39	3 hy @ 50ma	.29
120 hy Dual @ 17ma	1.39	30 hy Dual @ 20ma	1.49
.1 hy @ 5 amps	6.95	10 hy @ 100ma	1.29
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the *Specialty Division*, the booklet includes chapters on the theory and practical applications of the cathode-ray oscilloscope and the sweep frequency signal generator, and basic FM circuits. The publication is profusely illustrated with schematic drawings, block diagrams, sketches, and curves.

Copies of the booklet (ESD-21) are obtainable from *General Electric* distributors. The price is $0.25.

CORNELL-DUBILIER CATALOGUE

Cornell-Dubilier's new catalogue, No. 200, has been designed both as a handy reference book and complete capacitor listing in addition to offering the retailer and repairman the usual ordering service.

This 24-page catalogue, illustrated with detail drawings as well as halftones, covers more than twenty different classes of capacitors manufactured by the company. Each type of unit is described in detail both as to construction and service. Many of the descriptions are supplemented by working drawings.

A copy of Catalogue No. 200 may be obtained by writing to *Cornell-Dubilier Electric Corporation*, South Plainfield, New Jersey.

MICROPHONE FOLDER

Electro-Voice, Inc., is offering a copy of its colorful bulletin covering the *E-V* Model 805 Contact Pickup Microphone for stringed instruments.

Known as Bulletin No. 136, the new publication fully describes and illustrates the new product which has been designed to provide smooth, natural sound reinforcement of instrumental music including the guitar, banjo, mandolin, violin, viola, cello, harp, drum, and piano.

Complete specifications and a sketch showing the simplicity of mounting and detaching the microphone are given.

A copy of Bulletin No. 136 will be sent on request. Write to *Electro-Voice, Inc.*, Buchanan, Michigan.

BLILEY BULLETIN

Distribution of Bulletin 36, covering crystals for all types of commercial applications, is being handled by the salesmen and distributors of *Bliley Electric Company* of Erie, Penn.

Included in this 9-page bulletin are crystals designed for transceivers, broadcast monitors, frequency standards, precision test equipment, communication receivers, signal generators, secondary standards, marine radio telephone, emergency service applications, vehicular and airborne equipment, etc.

Details of the company's CCO-Model 1C crystal controlled oscillator and their packaged v.h.f. crystal control unit are also given. A handy table of frequency tolerance requirements for various radio services is also given.

Copies of this bulletin covering crystals for commercial applications may be secured from the company's distributors. —30—

Simple Converter

(*Continued from page 55*)

sistor, R_1, to give a close match for the line. In the event that lines of other impedance are used, R_1 should be changed to correspond with their impedance.

Bias for the r.f. tube is supplied by the cathode resistor R_2. This resistor is not bypassed as the operation of this stage depends on the r.f. input being introduced into the cathode circuit. The purpose of condenser C_1 is simply to act as a coupling medium between the antenna circuit and the cathode.

The plate of the r.f. stage and the grid circuit of the mixer are tuned by the combination of C_2 and L_1. This *LC* circuit is coupled to the grid of the mixer by C_3. R_3 completes the grid return for the mixer. Bias for the mixer portion of the tube is furnished by resistor R_5 in the cathode circuit of the tube.

The grid leak of the oscillator portion of the tube is returned directly to the cathode of the tube, so that only the voltage developed across the grid leak in an oscillating condition, appears on the oscillator grid.

The coils are designed to give full coverage of the ten, eleven, and six meter bands, with a small overlap at each end. This requires that the necessary padding condensers be included with the coils, to provide automatic changing of condensers as the coils are changed. Details of the capacities used are given in the coil table.

In the construction of the coils, care should be taken to place the coils as far as possible from the shield plate. Sufficient coupling exists between the elements of the tube to give satisfactory mixer injection for optimum performance. Triode converters are very tolerant in the amount of oscillator voltage, and no adjustment of the injection voltage is necessary.

The oscillator for the ten meter band operates on the high frequency side of the signal, while the six meter oscillator is tuned to the low frequency side. This simplifies the method of obtaining complete bandspread on both bands, and accounts for the six meter oscillator coil having more turns than the ten meter oscillator coil.

A coaxial antenna terminal is used for the input to the converter. Resistor R_1 and condenser C_1 are mounted on the rear of this terminal, and a length of small diameter coaxial cable run from the junction to the cathode resistor R_2.

The output from coil L_1 is brought to a terminal strip mounted on the rear edge of the chassis. Both terminals are insulated from ground to allow the converter to be used with receivers having balanced input.

Two toggle switches are mounted on the front panel. The left hand switch controls the "B" voltage for

standby purposes. The right hand toggle controls the primary of the heater transformer T_1 and the a.c. supply to the rectifier.

When construction has been completed, the tubes and one set of coils should be put in place, the power switch turned on, and the tubes allowed to heat. It is advisable to let the unit run about fifteen minutes to reach a stable operating temperature.

The voltage should be checked at the input and output of the filter circuit, and should approximate that shown on the schematic diagram, with S_1 closed.

The frequency of the oscillator should then be checked by means of an accurately calibrated receiver or frequency meter. For the ten meter coil, the range of the oscillator should be from 37 to 40 mc. with a small amount of overlap at each end. The proper procedure is to set the tuning condenser to minimum capacity and adjust the trimmer condenser across the oscillator coil to 40 mc. The tuning condenser should then be turned to maximum and the frequency again checked. The frequency will be 37 mc. if the coil is correct. However, it is probable that the coil will require some adjustment. If the overall range is too great, it is an indication that the coil has too much inductance. The inductance may be reduced by stretching the coil slightly. Too little range is caused by insufficient inductance, and may be cured by squeezing the turns together. A few adjustments will center the band on the dial.

The converter may now be connected to the receiver, and the receiver tuned to a clear spot at approximately 10 mc. The trimmer across L_3 should then be adjusted for greatest noise output from the receiver, indicating that the coil L_3 is tuned to the receiver frequency.

After this is done, the mixer grid coil L_1 should be adjusted to track across the band when an antenna is connected to the input of the converter. If the tests are made during a period when the ten meter band is open, no difficulty will be experienced in finding plenty of stations.

It is desirable to know whether the coil has too much or too little inductance. This may be accomplished easily if a small piece of brass rod, and an iron core from an old r.f. or i.f. coil are available. These should be mounted one on each end of a piece of bakelite rod or similar insulating material. These make very useful tools for aligning purposes and are widely used in radio factories.

Inserting the brass rod in a coil will reduce the inductance, while the iron core end will increase the inductance. In this manner it may be quickly determined whether more or less inductance is needed.

This type of tool is ideal for aligning the L_1 coil as it is easy to make the proper adjustment in the coil. When the coil has been properly ad-

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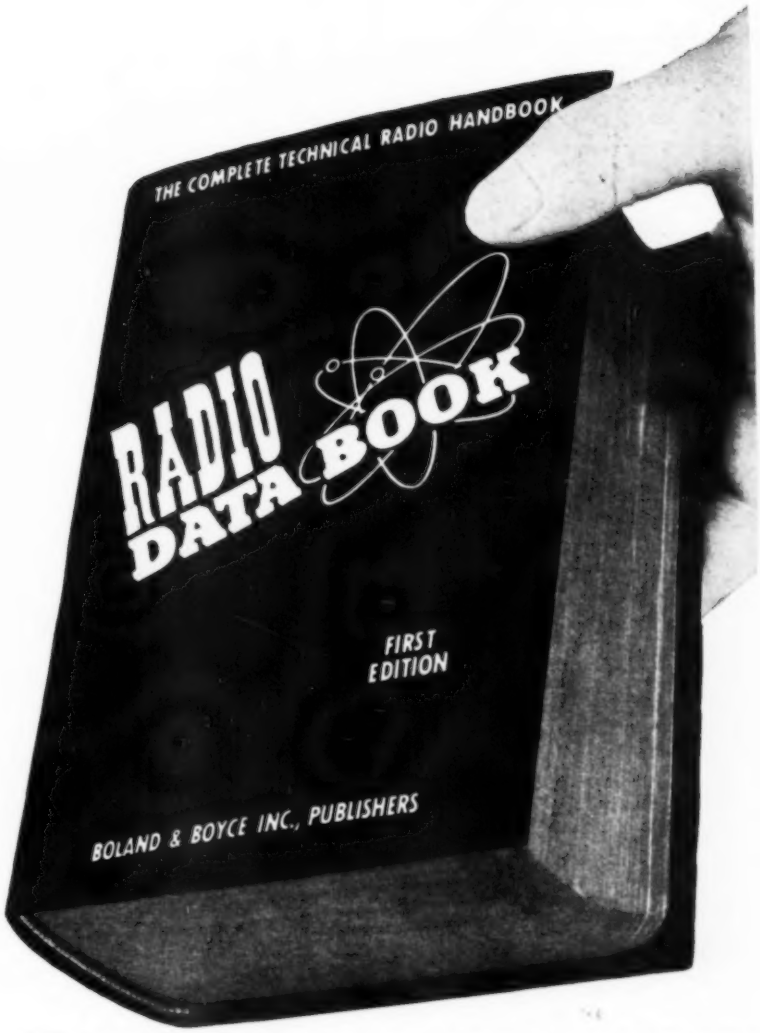

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justed, insertion of either end of the aligning tool will result in a reduction of signal strength. As before, with the oscillator coil, the inductance may be increased by squeezing, or reduced by stretching the coil. Of course it is not possible to do much squeezing on a closewound coil, but sufficient variation may be obtained for proper tracking.

When the ten meter coil has been adjusted, the same procedure should be followed on the six meter coil. In this case the oscillator frequency will be 40 to 44 mc. The output transformer need only be adjusted once, however, regardless of which coil is used. It will probably be found that the adjustment of the six meter coil is somewhat more critical than the one for ten meters. The mixer grid coil for six meters has a built-in trimmer and this should be adjusted for tracking at the high frequency end of the band.

In the event that difficulty is experienced in picking up the oscillator signal in the receiver or frequency meter, a meter of 25 ma. range may be connected in the plate lead of the oscillator section. Oscillation will be indicated by a sharp increase in plate current when the stator plates of the oscillator condenser are touched. An absorption type frequency meter may be coupled to the oscillator coil and tuned through its range. When the oscillator frequency is reached, the plate current will jump sharply. This method may be used for a quick check of the frequency.

It is very important in high frequency construction that all grounds for a particular circuit be returned to a common point. This is necessary to prevent chassis currents. Much of the trouble in high frequency equipment may be traced to failure to observe this precaution. Probably the best point for location of these grounds is one of the mounting screws of the tube sockets. In any event care in picking central ground points for the respective grid and plate circuits will pay dividends in trouble-free performance.

An attempt was made to extend the range of the converter to the two meter band but the results were disappointing. It appears that the length of the leads from the coil to the condenser are too great, with the result that the majority of the circuit inductance lies in the leads connecting the coil and condenser. However at the present time plans call for further work on this problem. Possibly the use of the butterfly type condensers will offer some improvement.

There is also the possibility of using a separate converter for each band. The low cost of the parts needed, using a common power supply, plus the better efficiency, should have considerable appeal.

Converters could be built for the 10, 6, and 2 meter bands, with a common power supply and gang tuning.

—30—

Atom Smashers

(*Continued from page* 41)

the vacuum chamber is between the poles of the electromagnet, the field causes them to move in a semicircular direction. By the time the particles return to the gap the oscillation has reversed the charges on the dees. The timing is well nigh perfect since the angular velocity of the particles is independent of their linear velocity. The

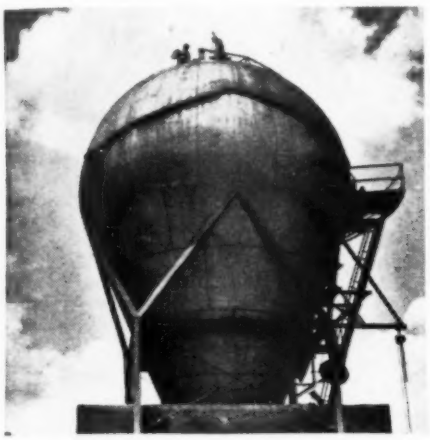

Fig. 6. The Westinghouse atom smasher.

particles are then pulled to the other dee and speeded in their flight. Once again the path of motion is a semicircle but with a greater radius. By the time they again return to the gap the charge on the dees has again reversed. Thus the path of the particles is around and around, coasting while in the dees but accelerating every time they cross the gap. As they move faster and faster their semicircular path becomes larger and larger until eventually their path is near the outer edges of the dees. A negatively charged electrode then pulls them from the dees entirely, allowing them to pass through a thin metal window.

With the atom smashers discussed in this article, scientists now have

Fig. 7. The "Giraffe"—an electronic tube used in conjunction with a Geiger counter is shown at the Westinghouse Laboratories.

the necessary means for a more thorough study, under controlled conditions, of the transmutation of matter.

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—30—

SIMPLE DIPOLE TELEVISION ANTENNA

By EDWARD M. NOLL

THE simple dipole, a half-wave antenna separated into quarter-wave elements and center-fed, is an effective television antenna in high-level signal areas where the signal-to-noise ratio is high. The dipole is a low impedance antenna and has an antenna resistance of 72 ohms, very conveniently matching a 75 ohm coaxial line. It can also be matched to a 300 ohm twin-wire line through a matching section or it can be attached unmatched to a 300 ohm line in which case there is attenuation but a comparatively wider frequency response.

Each element of the dipole is an electrical quarter-wavelength which is slightly shorter than a calculated quarter-wavelength in free-space. This correction has been taken into consideration in the calculation of the antenna lengths for each individual channel given in the chart. These dimensions are for peak performance on each individual channel. If antenna is cut for reception of a number of channels use the mean frequency of the channel allocations in your area to determine element length.

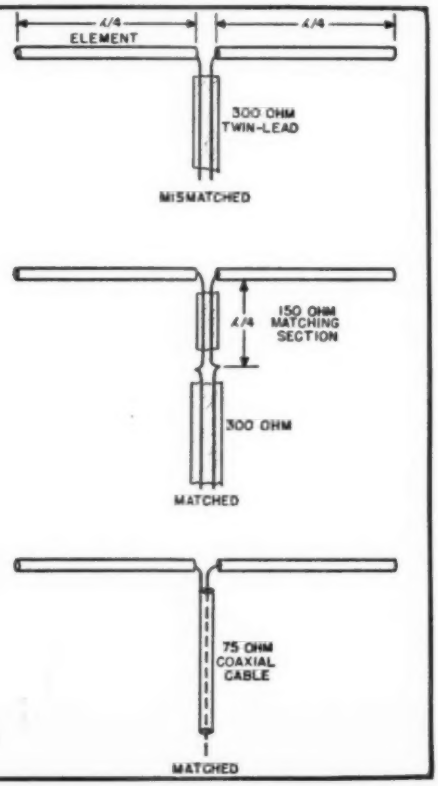
The mismatched dipole is only satisfactory in areas in which the signal is strong and the signal-to-noise ratio high. There is appreciable signal attenuation but the match between transmission line and standard 300 ohm resistive receiver input prevents line reflections. In addition the bandwidth of the antenna system is widened.

If signal is weak and noise prevalent, the antenna should be matched to obtain maximum signal utilization. A 75 ohm coaxial line matches a dipole and in addition the outer conductor acts as a shield and reduces noise pick-up. However, a 75 ohm line can only be used *if the receiver has facilities to obtain a 75 ohm input.* It is better to mismatch the antenna than to mismatch at the receiver termination. Some commercial receivers have means of changing over from the standard 300 ohm input to a 75 ohm input.

A simple dipole can also be matched to a 300 ohm line with a quarter-wave matching section. In this case the impedance of the matching section line is a mean between antenna resistance and the 300 ohm line, or 150 ohms. The electrical quarter-wavelength of the twin-wire matching section is considerably shorter than a free-space quarter-wave because of the lower velocity constant of the ribbon dielectric as compared to air. A .82 constant was used in the matching section lengths given in the chart. —30—

Methods used to connect dipole antenna to television receiver. Chart gives exact dimensions of dipole elements for various television channels.

CHANNEL	λ/4 ELEMENT IN INCHES	λ/4 MATCHING SECTION 150 OHM TWIN-LEAD
1	60	51
2	49	42
3	44	38
4	40	34
5	35	30
6	33	28
7	15¾	13½
8	15¼	13
9	14¾	12½
10	14¼	12
11	13¾	11½
12	13½	11¼
13	13¼	11
MEAN HIGH CHANNELS 195MC.	14¼	12
MEAN LOW CHANNELS 66 MC.	42	36



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A.F.C.

(*Continued from page 60*)

plying the error voltage directly to the blocking oscillator it is first amplified to get more voltage and better control.

Tube V_1 is the sync pulse amplifier for the horizontal pulses which are impressed on the grid of the phase-splitter, V_2. It will be noted that this tube has the same amount of resistance (R_1 and R_2) in both plate and cathode, which will produce pulses equal in amplitude but opposite in phase. The positive pulse coming from the plate of V_2 is applied to the cathode of one diode, V_3, while the negative pulse from the cathode of V_2 is put on the plate of the other diode, V_4. The plate and cathode of V_3 and V_4, respectively, are connected together and will develop a d.c. voltage across the filter which consists of C_6 and C_7 and R_{11}. This will be the error voltage.

Resistors R_9 and R_{10} serve as d.c. return paths to ground for the error voltage. The saw-tooth voltage from the plate of the saw-tooth amplifier is changed to a pulse by the shaping network C_4, C_5 and R_6. This pulse voltage is divided equally by the voltage divider R_7, R_8 R_9, and R_{10} and is superimposed on the sync pulse. When these two pulses are of exactly the same frequency, they will produce no current through the two diodes but if, for instance the locally generated pulse is faster, that will affect the current of only one diode, causing a voltage of a certain polarity to appear on the grid of V_5, the d.c. amplifier. When the local pulse is slower, the other diode will conduct and the voltage on the grid of V_5 will be of opposite polarity. That is just what is necessary to control the saw-tooth generator.

A blocking oscillator is employed, followed by a discharge tube to produce a saw-tooth voltage. The frequency of this oscillator is controlled by the bias on the grid, and this bias is determined by the plate voltage of V_5, the d.c. amplifier. A rough adjustment is made by varying R_{11}, a series resistor in the grid circuit of the blocking oscillator. Condenser C_9 is essential to the function of the blocking oscillator, but usually appears in series with the blocking transformer. Nevertheless, its function is still the same and its time constant has to be in accordance with the desired wave shape.

The incoming sync pulses will be of a steady frequency while the frequency of the blocking oscillator may be adjusted, for instance—too slow. Instantly the saw-tooth is fed back to the a.f.c. system and an error voltage is developed. This error voltage will charge condensers C_6 and C_7, and not until the latter, a 40 μfd. unit, is charged is the full error voltage developed on the grid of the d.c. amplifier and, in turn, not until then

has the plate voltage of that tube changed, thus changing the bias on the blocking oscillator tube. That is why the picture sometimes moves into sync visibly and gives a wavering appearance until it is finally locked in. Once the proper frequency has been reached it is rather difficult to throw the blocking oscillator out of sync, because condenser C_7 retains a certain charge due to the small but constant diode current which flows regardless of signal and which keeps the grid of V_5 and, in turn, of V_6 at a constant potential.

Should occasional noise pulses be received, they would not be regular and frequent enough to affect the constant d.c. voltage, and, therefore, have no effect on the sync of the picture. Another advantage is that once the frequency control R_{11} is set—even though only approximately, the a.f.c. will bring the picture into sync each time unless a great change occurs in any of the circuit constants. Naturally that means less need for adjustment and many manufacturers who use a.f.c. are planning to put the hold controls on the rear of the chassis, and have them adjusted only once, at the time of installation.

The system described in this article is but one of the many possible combinations. Fig. 2, a similar system is shown, and this is slightly better adapted for manufacturing since it requires fewer components and the voltage divider does not have to be exact. Again a phase-splitter for the incoming sync pulse is employed but this time the feedback pulse is applied to the opposite plate and cathode. The principle, however, is still the same.

The error voltage is obtained through R_8 or R_9, depending on whether it is positive or negative. The combination R_{10} and C_7 tends to reduce the action of the d.c. amplifier and the bias for the blocking oscillator is again obtained through R_{11} and hold control R_{12}, from the plate of the previous tube. In this circuit the feedback saw-tooth is obtained from the secondary of the output transformer and a slightly different wave shaping network (R_6, R_7, C_4 and C_5) is necessary.

The outstanding characteristic of this last a.f.c. circuit is that the ratio of the sync pulse amplitude and the amplitude of the feedback pulse is ten to one, with the sync pulse usually being 40 volts peak-to-peak and the feedback pulse 4 volts. As long as this ratio is kept, this system performs extraordinarily well.

In Fig. 4, the a.f.c. circuit of the present *RCA* Model 630 TS television receiver is shown. It goes under the commercial name of "Eye Witness" sync, and is an *RCA* patent. It is slightly more complex than the systems hitherto discussed but the basic principle is retained. V_1 is again the sync amplifier and this time no phase splitter is used, instead the sync pulse is put on the centertap of the primary of discriminator transformer T_1. This

transformer is permeability tuned and its secondary is the tapped inductance for a Hartley oscillator using V_4 as the oscillator tube. The tank circuit is completed by C_5 and C_6, and the capacity of V_3 which is used here as a reactance tube. This oscillator circuit produces a sine wave which is changed into a saw-tooth wave by the discharge tube V_5. The frequency comparison takes place in the duo-diode V_2 by means of the induced signal and the center-tapped primary. The error voltage is developed across R_4 and R_5 which go to a -2 volt tap in the power supply bleeder, and thus provides a fixed bias for the reactance tube V_3. When an error voltage is developed it adds or subtracts from the bias and therefore changes the capacity of the reactance tube. This, in turn, changes the frequency of the oscillator, producing the desired correction.

The problem of the serviceman is usually how to recognize a faulty a.f.c. system, since loss of sync is not necessarily due to the a.f.c. If, for instance, one of the sync amplifiers or the clipper is not functioning properly, no sync pulse may reach the discriminator and the a.f.c. cannot function. Usually only the horizontal sweep employs a.f.c., while the vertical works on direct sync, so that, when the picture does not seem to move up or down, it is safe to assume that the portions of the clipper and sync amplifier which contain both horizontal and vertical pulses, are all right and the trouble must, therefore, be in a section containing only the horizontal pulse. On the other hand, if it appears impossible to get either the vertical or the horizontal into sync, then obviously it cannot be the fault of the a.f.c., and the trouble is probably in the clipper or amplifier. A good oscilloscope will permit tracing the sync pulses through the circuit and thereby greatly facilitate trouble-shooting. This fact has been recognized by most television service organizations which invariably possess and use suitable scopes.

In conclusion it may be said that it is very desirable to have a.f.c. in the horizontal sweep circuits of the more expensive television receivers, especially those having a screen diameter of 10 inches and up, to facilitate adjustment and prevent "tearing" and loss of sync due to noises or unstable oscillators. A disadvantage of a.f.c. is the need for at least four additional tubes, although this is usually minimized by using one duo-diode and a duo-triode. However, the added number of components and necessary adjustment in production do mean added expense. Servicing problems with regards a.f.c. systems are greatly reduced when the trouble is located in one particular section by judging the symptoms and deducing their causes. Once a serviceman gets better acquainted with the appearance of sync trouble, he will have no difficulty locating and repairing it.

—30—

Recording of Sound

(*Continued from page 64*)

fairly reliable indication of how much surface noise will exist in the finished record.

Recording Levels

Considerable experience and skill is required in order for the recordist to obtain top quality results from his recordings. It is not practical to make an exact statement of the correct operating level for any particular recording head or setup. The correct level can be established only by experience and test. There are no fixed boundaries in disc recording representing 100% modulation. At low frequencies the groove spacing limits the possible amplitude of the cutter. At high frequencies the radius of turning of the groove is the limiting factor.

It is not difficult to find the correct operating levels for a complete installation if test cuts of speech and music are made at the same standard record speeds using the smallest contemplated groove diameters. These test cuts should be made at gradually increasing levels and the results should be noted when the records are reproduced. When the reproduction ceases to be acceptable from a quality standpoint, the maximum level has been exceeded. The presence of a very small amount of distortion is sometimes less objectionable than excessive surface noise which is one reason, from a practical commercial standpoint, for not being guided too strictly by measured distortion. It is well to keep in mind what type of equipment will be used to reproduce the recorded material. Only the most advanced type of pick-up with a diamond or sapphire stylus should be used if best quality of reproduction with low noise level is desired from acetate type recordings.

Records for 33⅓ r.p.m. cannot be cut at as high a level as records for 78 r.p.m. because of the reduced surface velocity of the record material. It is equally necessary to reduce the recording level at least 6 db. on the 33⅓ r.p.m. discs. A higher level is usually used for 33⅓ r.p.m. lacquer master discs for processing than for recordings where the original is to be played back repeatedly. A high level soft lacquer original will not withstand repeated playbacks. However, the surface noise with these discs is low so that there is no need for the maximum level.

All disc recordings suffer from loss of high frequency response during playback in the area nearer the center of the disc. As the diameter of the record grooves become smaller, the condition becomes progressively worse because of the reduction in the linear speed of the recorded groove. With the slower groove speed, the actual linear distance

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available for a complete cycle of, for example, a 10,000 c.p.s. tone, becomes very short. The cutting stylus has a front face which is a flat plane and can record the high frequencies at the slower groove speeds without difficulty. The limiting factor becomes apparent when an attempt is made to reproduce this recording. The reproducing stylus must have a tip of spherical shape. It is obvious that this tip cannot follow a recorded groove whose radius of turning is less than the radius of the stylus tip. It is therefore desirable to confine high fidelity recording to large diameters, dividing the time on two or more discs if necessary for maximum quality. Records having extended frequency range cannot be made at a diameter of less than nine inches for 33⅓ r.p.m. without an extreme loss of high frequency response.

In making high fidelity records, including discs for immediate playback, use can be made of what is a known as complimentary compensation. Because of the energy distribution in most speech or music it is possible to accentuate the higher frequencies when making a record and then to attenuate these frequencies by a like amount in reproduction, thereby reducing the surface noise resulting from minute foreign particles in the record stock.

For high quality recordings the frequency rise should begin at about 700 c.p.s. and should increase smoothly to a maximum of 16 db. at 10,000 c.p.s. Filters, such as the *RCA* orthocoustic recording filter MI-4916, have been designed for this purpose. In reproduction the inverse of this rise should be employed. Pre- and post-equalization, as this method of compensation is often called, results in a substantial reduction of surface noise. Another form of high frequency compensation involves the use of automatically variable equalizers designed specifically for 33⅓ r.p.m. recording. With these devices the high frequency compensation is progressively increased as the recording groove diameter becomes smaller. The equalizer mounts on the rear of the recorder mechanism and is synchronized with the cutter head so that the amplifier gain is increased at the high frequencies to an amount which is considered a practical maximum.

Record playing time. Note that 17¼ inch blanks used for recording the "masters" should be recorded as 16 inch blanks.

Grooves Per Inch	Turntable Speed r.p.m.	Approximate Playing Time (minutes)		
		16-inch Record	12-inch Record	10-inch Record
96	78	6½	4	2¾
112	78	7½	4½	3¼
120	78	8	5	3½
136	78	9	5½	3¾
154	78	10	6	4
96	33⅓	14	8	4¼
112	33⅓	16	9¼	6
120	33⅓	17	9¾	6
136	33⅓	18	10	6
154	33⅓	20	11	6½

The term "flutter" is used to describe a vertical wave or oscillation which is sometimes cut in the recorded groove. This condition can often be seen as a series of radial spokes or patterns in the record surface. These patterns are usually visible before the record is reproduced although sometimes they may be seen more plainly after playing. When viewed through a microscope, this condition appears as an alternating change in width of the cut groove. Flutter may be caused by a building vibration, low frequency turntable rumble, incorrect stylus angle or a blank having an unusually wavy surface. Hard spots in a blank will result in a condition similar to that caused by flutter. As the stylus passes over harder and softer portions of the surface, the cutter head is raised or lowered slightly, causing a variation in the depth of groove. This variation should not be mistaken for flutter or oscillation since it is the original action of a well designed and free acting recording head. A distinctive characteristic of hard spots is their prevalence near the outside of the blank. Therefore, variations in groove depth due to hard spots will be more prevalent in this region.

Bouncing

When a valley is encountered when cutting a disc, bouncing will occur due to lack of sufficient pressure from the cutter and stylus. The result is illustrated in Fig. 4.

Cutter Adjustments

It is important that the feed screw mechanism be adjusted so that the carriage supporting the recording head travels in a plane exactly parallel to the surface of the turntable in order that the depth of cut will be uniform over the entire record surface. The front face of the stylus, when in the cutting position, should be adjusted to within plus or minus three degrees of perpendicular. Some experiment may be necessary to find the most satisfactory angle for any given surface material. It is advisable not to stop the turntable with the recording head in cutting position since the stylus may cut through the acetate coating to the metal core of the blank. This will chip the cutting edge of the stylus when the turntable is moved or the head raised.

Tests

It is good practice to make surface noise tests from time to time with all of the cutting styli available. This will assist the operator in selecting only those cutters which produce clean, quiet grooves. Present standards require the noise level on lacquer records to be down 50 db. from normal recording level. When checking noise it is necessary to refer the noise level to some standard level. It is suggested that the 1000 c.p.s. tone band of a standard tone record be selected as a reference level.

To determine the noise level, con-

Grooves Per Inch	Combined Width of Groove & Wall	Groove Width		Wall Width		Groove Depth			
						70° Stylus		90° Stylus	
		From	To	From	To	From	To	From	To
96	.0104	.0052	.0042	.0052	.0062	.0022	.0015	.0018	.0013
112	.0089	.0044	.0036	.0044	.0053	.0017	.0011	.0014	.0010
120	.0083	.0041	.0034	.0041	.0049	.0014	.0009	.0012	.0009
136	.0073	.0036	.0029	.0036	.0044	.0011	.....	.0010	.....
154	.0065	.0032	.0026	.0032	.0039	.0008	.....	.0008	.....

Groove dimensions.

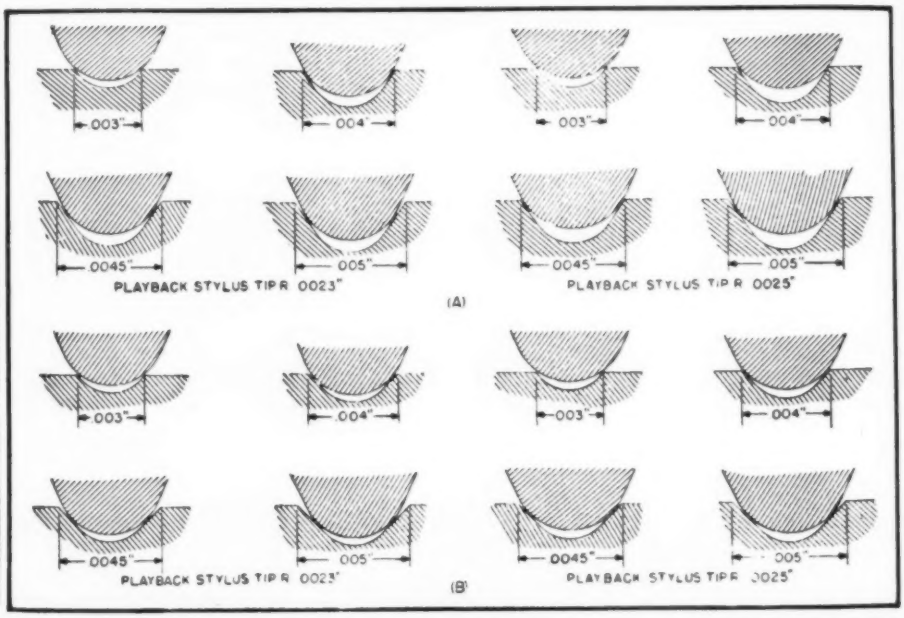
nect a high fidelity pickup through a calibrated attenuator to the input circuit of a high gain amplifier. Insert a high pass filter, such as the one contained in the MI-4917-A variable sound effects filter by *RCA*, in the circuit to eliminate all frequencies below approximately 200 c.p.s. The electrical location of the high pass filter is important. If two amplifiers are used connected in cascade, the ideal electrical location for the filter is between the amplifiers. Should it be necessary to use a single unit amplifier, the filter may be connected between the pickup and the amplifier input. Be sure to provide adequate shielding for the filter when using it in this position, however, since the hum pickup may be severe. Connect the amplifier output to a loudspeaker and a volume level indicating meter. Play the 1000 cycle tone band and then the noise sample. Adjust the output of the amplifier with a calibrated attenuator until a similar indication is obtained on the volume level indicating meter. The attenuator reading indicates directly the noise level in db. below reference level.

A convenient method for determining the presence of noise or scratch consists of connecting the cutter head as a reproducer. Insert the stylus to be checked in the cutter head and connect the leads from the head directly to the input terminals of the high gain amplifier which has a loudspeaker connected to its output terminals. Cut grooves in the record material, preferably near the outside diameter. Arrange the gain of the amplifier sufficiently to hear the sound made by the cutter. A steady hiss indicates a good grade of lacquer and sharp, properly adjusted stylus. Scratching, squealing, or tearing sounds indicate a dull or improperly adjusted stylus. Clicking or banging may indicate the presence of foreign particles in the lacquer.

Groove Spacing

The correct groove width is largely determined by the radius of the tip of the playback stylus, and by the signal level at which the recording is made. The groove should be wide enough so that the playback stylus tip contacts the side walls of the groove approximately 0.5 mil. below the surface of the record. Then ordinary light surface scratches will not be reproduced and will not add to the over-all record noise. Most lateral transcription pickups use styli which have tip radii between 2.3 and 2.5 mils. In order to obtain the proper fit, a groove width of 4.5 mils. or greater is recommended for cutting styli having either a 70 or 90 degree included angle. Fig. 6 illustrates the theoretical fit for various sizes of playback

Fig. 6. Theoretical seating of stylus in grooves of various widths. (A) Grooves cut with 70° stylus, (B) grooves cut with 90° stylus. (Tip radius .0017")



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Buy 1 for	$11.75	and save	$1.00
Buy 2 for	23.00	and save	2.50
Buy 3 for	33.75	and save	4.50

ESPEY CUSTOM-BUILT AM-FM HIGH FIDELITY RECEIVERS
Model No. 7-B. List price $140.00. Your price $82.50. $25 deposit required with C.O.D. orders. 11-tube AC Superheterodyne AM-FM receiver. Folded dipole antenna for FM supplied. Wired for phonograph operation. Requires nothing but a cabinet. Ideal for custom builders.

FM COIL & CONDENSER KIT $4.95
Designed for operation on 88-108 MC (new band). Contains 2 IF transformers, 1 Limiter transformer, 1 Discriminator transformer, 1 oscillator coil, 1 RF coil, 1 variable condenser, schematic and wiring instructions. Excellent for schools, experimenters and radio hobbyists.

PROGRESSIVE ELECTRONICS CO. Dept. RN-7

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styli and groove widths. The tip radius of the cutting stylus should be 0.4 or 0.5 mils. less than that of the playback stylus so that the bottom of the record groove is cleared and does not form the major support for the reproducing tip.

To determine the pitch (number of grooves per inch) at which the record is to be cut, add to the groove width twice the maximum amplitude of expected stylus excursion (due to signal) plus an allowance for safety factor. Assume a normal stylus excursion of 0.626 mils. and a maximum of 10 db. above this or 1.98 mils. Twice this is 3.96 mils. plus a safety factor of 1.0 mil. added to a groove width of 4.5 mils. equals 9.46 mils., or about 109 grooves per inch. Low frequency peak amplitudes of 10 db. above normal are infrequent and it is questionable if two maximum stylus excursions will occur in adjacent grooves at such time and phase as to cut into each other. Therefore, some liberty can be taken and a slightly smaller pitch, about 7.35 mils., or 136 grooves per inch, is usually considered satisfactory when using a 70 degree cutting stylus.

The groove width should, however, never be less than 4.5 mils. when a playback stylus with a 2.3 or 2.5 mil. tip radius is used.

The tabulation (see page 152) shows the practical limits of groove and wall widths. All dimensions are in inches.

The author wishes to express his appreciation to *RCA* for many of the illustrations and the reference material used in this article.

(To be continued)

Cross-Modulation

(Continued from page 56)

in others to pickup in high-gain audio stages. All such cases were located within areas of extremely high field intensities, however, and represent a very small part of interference complaints. More common sources of cross-modulation are; (1) exposed power wiring, particularly if overhead mains are used; (2) poor electrical contact between sections of metal roofing, drain pipes, metal chimneys, electrical conduit, etc., and; (3) oxidization or poor contact in the antenna or ground system, guy wires, or nearby wiring. Often such objects as a galvanized clothesline may be the source of r.f. pickup and rectification without actually coming in contact with the antenna system.

Several years ago, WLW engineers investigated almost 100 cases of cross-modulation in Cincinnati. Of these cases, the sources of interference (in the order of their appearance) were; (1) loose connections, (2) complainant's receiver, (3) vent pipes, (4) image frequency, (5) downspout, (6) radiator pipe, (7) sink drain pipe, (8) antenna dragging on a metal roof. Of the total number of cases involved, over 10 per-cent were due to loose connections which allowed oxidization or rust to occur.

Methods of Elimination

The source of cross-modulation can best be located through the use of a portable battery receiver operated as a direction finder. The receiver

CHANGES IN STANDARD FREQUENCY BROADCAST

EFFECTIVE January 30, 1948, the technical broadcast services from radio station WWV of the National Bureau of Standards were somewhat modified and improved, according to an announcement by Dr. E. U. Condon, Director of the Bureau.

Each of the eight radio carrier frequencies 2.5, 5, 10, 15, 20, 25, 30 and 35 megacycles are now being broadcast continuously day and night. Standard audio frequencies of 440 and 4000 cycles per second are transmitted on the carriers 10, 15, 20, and 25. The 440 cycle frequency, which is the standard of musical pitch (A above middle C), is also being broadcast on 2.5 and 5 megacycles. The accuracy of each of the transmitted radio and audio frequencies is better than one part in 50 million.

The attention of all users of the National Bureau of Standards time announcements is particularly called to the following change: Time announcements in International Morse Code, accurately synchronized with basic U. S. Naval Observatory time, have been advanced one minute with respect to the old announcement scheme. With the new system the audio frequencies are interrupted at precisely one minute *before* each hour and at each succeeding five-minute period. They are resumed precisely on the hour and each five minutes thereafter.

Under the old system, the time signals were interrupted for a minute on the hour and on each succeeding five minutes, while under the new scheme interruptions are for a minute precisely on the 59th minute, on 4 minutes past the hour, 9 minutes past the hour, etc., and resumed precisely on the hour and each five minutes thereafter. The exact moment to which the time refers is the moment of interruption of the audio frequencies of 440 and 4000 cycles per second. The audio frequencies will continue to be interrupted for one minute to allow for the time announcement, for station identification by voice at the hour and half hour, and to afford an interval for checking radio frequency measurements free from the presence of audio transmissions.

Station WWV provides six important technical broadcast services to the nation and five to the world, 24 hours a day. These are; (1) standard radio frequencies, (2) time announcements, (3) standard time intervals, (4) standard audio frequencies, (5) standard musical pitch, (6) radio propagation disturbance warning notices.

A detailed announcement of WWV broadcast services, LC886, will be provided upon request from the National Bureau of Standards, Washington 25, D. C.

-30-

should incorporate high sensitivity, be well shielded, and equipped with an electrostatically shielded loop antenna. Headphones are useful where absolute quiet is desired in tracing interference in apartment buildings, hospitals, etc.

In tracing the source of interference, the best receiver should be tuned to one of the *spurious* frequencies in which the cross-modulation occurs, *not* on the fundamental. If a broadcast station is being listened to, only the *cross-modulation background* will disappear when the source is removed. When *spurious* frequencies are used, however, these artificial frequencies are removed *entirely* when the source has been eliminated. These spurious frequencies are still fairly strong when cross-modulation on the broadcast signal has been virtually eliminated. To allow tuning to these spurious frequencies, the receiver should be capable of covering a range of approximately 1500 to 5000 kc. To facilitate probing among wires, pipes, and inaccessible spots, the antenna should be mounted on a handle several feet long and connected to the receiver through shielded leads. The outside of the loop should be completely taped or insulated to prevent accidental grounds or short-circuits.

To proceed with tracing, determine first which stations are cross-modulating. This may be done by listening for call letters or by identifying a familiar program. This check should preferably be made on the complainant's receiver, since one or more of the spurious frequencies will be in the broadcast band. Once the cross-modulating frequencies are known, the chart of Table 1 may be used as a guide in finding a number of spurious frequencies which will be within the tuning range of the test receiver. The antenna, ground, and a.c. leads of the complainant's set should then be checked for presence of these spurious frequencies, first by turning the set on, then off, while listening to the spurious frequency on the test receiver. If cross-modulation appears and disappears as the set is turned on and off, the receiver itself is the source. If not, proceed by removing antenna and ground from the set and connecting together. With the test receiver's loop held near the complainant's antenna, pickup from this source can be determined. Once it has been found that the source of interference is external, the test loop should be rotated slowly in the vicinity of the affected receiver in order to determine the approximate direction or maximum strength of the cross-modulating signal. It is usually easy to trace the radiated energy to its source by listening for an increase in signal as the source is approached. All plumbing, radiator pipes, and wiring should be moved or jarred while listening to one of the spurious frequencies. As the offending object is moved, the signal will respond or disappear accordingly. Next, the down-

spouts and drain pipes should be moved, pipes and wires in basement should be checked, and telephone and power grounds examined.

All pipes touching or making intermittent contact should be either bonded and grounded, or separated and insulated from each other and from nearby objects. Antenna and ground systems, including lightning arrestors, should be checked externally, and all vent pipes, clotheslines, etc. should be cleaned and grounded if necessary, and old or faulty antenna leads removed. It is often wise to clean or examine all possible sources of interference even after the actual *offender* has been located, in order to prevent callbacks when and if cross-modulation occurs in these places.

Leaded joints in steam radiators and pipes are often electrically faulty; these should be cleaned and bonded if necessary. Conduit and electric switch-box junctions should be checked for good ground contacts. Poor or oxidized joints in house wiring are often evidenced when the radio increases or decreases in volume when a certain light switch is turned off and on.

Since radiation from nearby buildings, lines, etc. is often responsible for cross-modulation, it is not always possible to locate the exact source of interference. In such cases, alteration of the receiving antenna and installation of a wavetrap, tuned to the offending signal, often are helpful. In other cases, installation of an a.c. line filter may be necessary. Suitable line filters may be purchased at most radio distributors and quickly installed. In these cases, make sure the set has a good ground connection and that all connections are clean and solid.

It has been noted before that a few cases were found wherein rectification occurred in a high-gain audio stage. The grid lead, if long, should be shielded, and all low-level leads dressed *away* from a.c. and filament wiring. If a glass tube is used, it should be equipped with a shield or replaced with a metal equivalent. In stubborn cases, a 50$\mu\mu$fd. mica condenser may be connected from control grid to ground.

Some of the trouble may be due to image frequencies. In this type of trouble, a strong station may be received at *two* frequencies, one its assigned frequency and the other differing by twice the i.f. frequency. A cross-modulation effect or a heterodyne "squeal" is caused when the difference or sum frequencies coincide with the frequency of another broadcast station. *Several* image points may be caused by local oscillator harmonics in the set. This trouble may usually be corrected by realigning or shifting the i.f. frequency so that its image frequency does not beat against that of another station. The set should also be thoroughly checked to ascertain whether r.f. is being picked up by one or more of the methods already mentioned.

		UNDESIRED STATION					
FREQ.	CALL	WKRC 1	WLW 2	WCPO 3	WSAI 4	WCKY 5	WKDU 6
550	WKRC	...	850	1910	2170	2510	2874
		...	1950	3010	3270	3610	3974
700	WLW	400	...	1760	2020	2360	2724
		1800	...	3160	3420	3760	4124
1230	WCPO	230	170	...	1490	1830	2194
		2330	2630	...	3950	4290	4654
1360	WSAI	260	140	1100	...	1700	2064
		2460	2760	3820	...	4420	4784
1530	WCKY	430	2760	3820	1190	...	1894
		2630	2930	3990	4250	...	4954
1712	WKDU	612	312	748	1008	1348	...
		2812	3112	4172	4432	4772	...

Table 1. Frequencies containing cross-modulation originating from six Cincinnati stations. "WKDU" is the local police frequency. The spurious side frequencies ($2f_2-f_1$ and $2f_2+f_1$) were used instead of the fundamental (f_1+f_2 and f_1-f_2) since experience has shown that these spurious frequencies are more reliable in locating sources of cross-modulation. Elimination of the source completely removes all artificial frequencies, whereas only the cross-modulation background disappears when a broadcast station's fundamental frequency is used. Furthermore, these spurious frequencies are still fairly strong when cross-modulation on the broadcast station has been reduced below on audible level. However, any of the other side (spurious) frequencies could have been used in preparing this table.

The author should like, at this point, to express appreciation to R. J. Rockwell, chief engineer of WLW, for permission to reproduce the chart contained herein. WLW engineers have conducted exhaustive research in investigation and correction of cross-modulation which included preparation of the formulas as well as part of the corrective information.

Radio servicemen in the larger metropolitan areas will be called upon to correct many such cases of cross-modulation from time to time; much of it, from local experience, has been present to some extent in many receivers and simply tolerated for years. Similar cases will be evidenced in other localities when new stations take the air or presently operating stations are granted power increases.

As long as the serviceman uses a thorough, conscientious method in tracing cross-modulation, he may be reasonably certain of eliminating it or, in the stubborn cases, of at least reducing it to a negligible degree. A considerable amount of time spent in tracing interference should by no means be considered as "lost time." It is rather a sure way of creating satisfied customers and paving the way to greater profits. —30—

The first two-way FM radio installed on police "Servi-Car" by the Harley-Davidson Motor Co. is tested by Chief Engineer William J. Harley as Radio Engineer Victor Sierpinski looks on. The new equipment weighs only 27 pounds and operates in the 152 mc. band. It requires an antenna of 18 inches. The "talkie" cycle is expected to expedite police operations by permitting instant two-way communications with headquarters.

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What's New in Radio

(*Continued from page* 88)

those produced by a fifteen-inch picture tube has been developed by the *Tube Department* of *Radio Corporation of America.*

The new picture magnifier is a transparent Plexiglas lens filled with clear oil having the same optical

properties as the plastic material, thus transforming it into a true optical lens.

In use, the magnifier is positioned in front of the viewing screen of the television receiver producing a picture area nearly three times the area of the directly viewed picture on a 7" tube.

Measuring 14½ inches high by 17½ inches wide with one flat and one spherical surface and an optical aperture 12 x 15 inches, the *RCA* 203P1 weighs approximately 24 pounds when filled. The magnifier may be used with any direct-view home television receiver.

The new magnifiers are now at *RCA Tube* distributors.

TUBE SOCKETS

Amphenol has developed three new industrial tube sockets to meet the requirements for mounting industrial tubes on the face side of vertical control panels.

These new sockets of phenolic material are designed to meet NEMA requirements and feature high conductivity cloverleaf contacts to insure extremely low contact resistance at the tube base pins. Individually supported, these sockets permit spacing to allow convection air current cooling of the tubes.

Two sockets have been designed to accommodate medium 4-pin, UX based tubes, one equipped with a protective collar around the tube base and the other without. The third type is designed for use with the super jumbo and industrial 4-pin based tubes. This socket is obtainable with or without the back terminal block. With the block in place, all connection wiring

may be made on the rear of the panel, and a bottom cover can be provided to totally enclose all wiring on the socket side of the panel. All three of these sockets feature solderless screw-type terminals to facilitate wiring harness maintenance.

American Phenolic Corporation, 1830 South Fifty-fourth Avenue, Chicago 50, Illinois, will supply additional information on request.

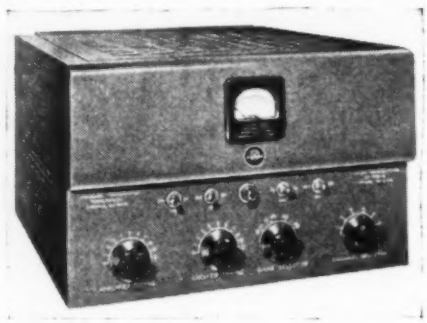
TRANSMITTER KIT

Standard Transformer Corporation is in production on the Model ST-202-A transmitter kit which provides transmission on 10, 11, 15, 20, 40, and 80 meter c.w.

When used with any modulator capable of 60 watts output, this unit may be used as a phone transmitter, or with a suitable FM exciter can be adapted for NBFM transmissions.

Amplifier plate power input is from 100 to 125 watts depending on the tube selected for the r.f. amplifier. The unit will operate on six bands between 3.5 and 30 mc. Internal frequency control is provided by six crystals.

The complete kit includes the cabinet with built-in chassis, appropriate panel markings, bottom plate, and all circuit and constructional components. It is also supplied with a prefabricated, cabled harness which accomplishes much of the wiring and assures a neat under-chassis construc-



tion. All phases of construction and operation are fully covered by a detailed instruction manual.

Further information on the ST-202-A kit may be secured from *Standard Transformer Corporation,* Elston Ave., Kedzie Ave., and Addison Street, Chicago 18, Illinois.

AIR VARIABLES

E. F. Johnson Company of Waseca, Minnesota has developed a new line of air variable condensers which are said to be the smallest ever built commercially.

The new line includes three models; single, differential, and butterfly types. Each of these three types is available in four different capacities.

The single type may be used in place of adjustable padders for trimming r.f. and i.f. oscillator circuits. The unit is available in 1.55 to 5.14 μμfd., 1.73 to 8.69 μμfd., 2.15 to 14.58 μμfd., and 2.6 to 19.7 μμfd. sizes.

The differential type may be used for switching capacity from a rotor to either of two stators and for shifting the tap on a capacity divider. This model is available in 1.84 to 5.58 μμfd., 1.98 to 9.30 μμfd., 2.32 to 14.82 μμfd., and 2.67 to 19.30 μμfd.

The butterfly type is applicable wherever a small, split-stator tuning

condenser is required. Four models include 1.72 to 3.30 μμfd., 2.10 to 5.27 μμfd., 2.72 to 8.50 μμfd., and 3.20 to 11.02 μμfd.

Full details on this new line may be secured from *E. F. Johnson Company,* Waseca, Minnesota.

REPLACEMENT KIT

Merit Coil & Transformer Corp. is currently making available a transformer replacement kit for servicemen.

Designed to eliminate the need for a "universal" replacement transformer, the kit contains 8 transformers, each designed and pretested for its particular use.

Each of the transformers is labeled individually on the frame with easily readable information giving the number and all necessary transformer data. The kit is housed in a special display box with a hinged cover.

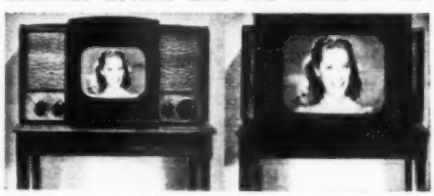
For further information apply to any *Merit* distributor or write *Merit Coil & Transformer Corp.,* 4427 N. Clark Street, Chicago 40, Illinois, for the name of the nearest distributor.

MAGNIFYING LENS

E. L. Cournand Company of New York is now manufacturing a new plastic magnifying lens which, according to the company, will triple the screen area of most television sets.

Marketed under the tradename "Walco Tele-Vue-Lens," this unit is fitted with brackets which slide under the television receiver so that the weight of the set holds the magnifier in position. The lens may then be adjusted both vertically as well as horizontally to produce the size picture desired by the viewer.

The manufacturer will supply additional details and the name of dis-



tributors where this unit may be secured. Write to *E. L. Cournand Company,* New York City.

IMPROVED INPUTUNER

A new model "Inputuner" with several refinements over the company's previous models has been announced by *Allen B. DuMont Labs., Inc.,* of Passaic, New Jersey.

This packaged r.f. head is available

to television custom-built and line-production set manufacturers. The "Inputuner" is a compact, rugged, foolproof assembly as easy to install as a speaker, according to the company. It requires no aligning, adjusting, or calibrating. Built around the *Mallory-Ware* "Inductuner" and including all necessary components for the complete r.f. head, it provides for continuous tuning in the 44 to 216 mc. range. This feature gives coverage of all 13 television channels plus FM, amateur, aviation, telephone, and commercial services in that range without a break. Only one tuning knob is required for both coarse and fine adjustments thereby doing away with the usual switch and vernier.

Manufacturers are invited to investigate this new "Inputuner." Inquiries should be addressed to *Allen B. DuMont Labs., Inc.*, 2 Main Avenue, Passaic, New Jersey.

NBFM MODULATOR

Bee-Bee Electronic Co. of Los Angeles is marketing the Model 500 NBFM modulator unit which has been designed for direct coupling to the v.f.o. or crystal socket of a conventional crystal controlled pentode or triode oscillator.

The unit permits NBFM operation with existing ham rigs without expensive speech equipment, or operation of phone rigs on c.w. ratings.

Phone quality of this unit depends entirely on the microphone being used with the rig.

Prices and additional information on the Model 500 may be obtained from *Bee-Bee Electronic Co.*, 2692 W. Pico Blvd., Los Angeles 6, California.

PROGRAM EQUALIZER

Cinema Engineering Company has designed a new program equalizer, the Model 4031-B, which is designed to meet equalization requirements for broadcast and recording studios.

A 12 db. equalization is effected at 100 cycles and 3, 5, and 10 kc. in calibrated and detected two db. steps. High and low frequency attenuation up to 16 db. in 2 db. steps is accomplished by merely turning the same control in a counter-clockwise rotation past the center point. A constant-K circuit maintains the level and eliminates wave distortion over the entire range.

Over 1465 curve combinations may be obtained with this unit. The

equalizer has only 14 db. insertion loss in a 500/600 ohm circuit, according to the manufacturer.

Literature on this Model 4031-B is available on request. Address inquiries to *Cinema Engineering Company*, 1510 West Verdugo Avenue, Burbank, California.

FM & TV ANTENNAS

JFD Manufacturing Co., Inc. is now offering a complete, new line of FM and television antennas which incorporates the company's exclusive polystyrene "Roto-Lock" insulator.

Included in the new line is a fringe area antenna that provides extremely broad-band and high gain reception. Because of its high directivity it is said to cut out unwanted signals and improve signal-to-noise ratio.

Also included are the "Upper Band" attachable antenna for the new TV channels, the "Removable" window antenna where permanent installations are not allowed, the "Hideaway" antenna which requires no outside installation, and a 300 ohm lightning arrestor which does not destroy the impedance of the 300 ohm line.

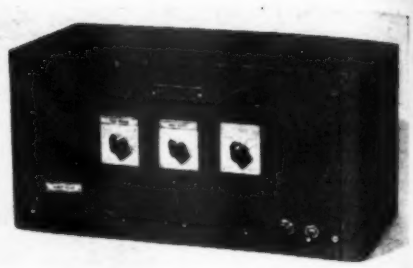
A brochure covering these new antennas may be secured upon request to Department A8, *JFD Manufacturing Co., Inc.*, 4117 Ft. Hamilton Parkway, Brooklyn 19, New York.

MULTIPLE POWER SUPPLY

Kepco Laboratories, Inc.'s new Model 103 multiple power supply was developed to meet the need for a source of power that would supply four commonly used voltages from a single compact unit.

The unit is particularly designed to be used in the study of the characteristics of vacuum and gas filled tubes as well as the characteristics of electronic circuits employing these tubes.

The power supply contains two continuously variable "B" supplies delivering from 0 to 300 volts at currents



up to 120 ma., one variable "C" supply delivering from minus 50 to plus 50 volts at 5 ma., and one heater supply delivering 6.3 volts at 5 amperes. Output ripple voltages is less than 1 millivolt over the entire operating range.

A data sheet covering the Model 103 may be secured from *Kepco Laboratories, Inc.*, 142-45 Roosevelt Avenue, Flushing, New York.

—30—

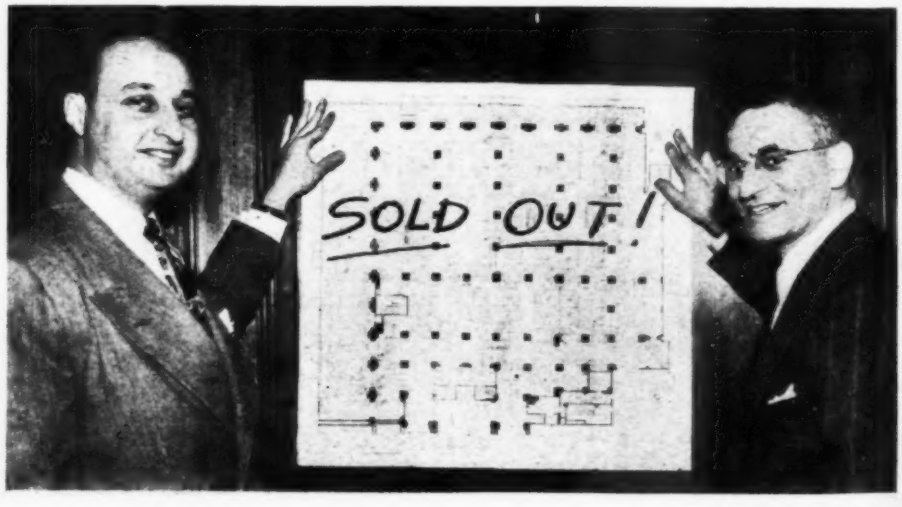
Signal Checker

(*Continued from page 44*)

is to be used externally, switch S_1-S_2 must be set to one of the "*OFF*" (unused contact) positions. This will disconnect the coils automatically, preventing a "short circuit" of the meter by a secondary coil and the crystal diode in series. When using the meter externally, the operator must remember that the bypass condenser, C_4, is still in parallel with the meter, although this will be of no concern in most d.c. circuits in which the microammeter normally will be used.

Headphone cord tips may also be inserted into pin jacks J_3 and J_4 for aural monitoring of modulated signals or for the use of the signal checker as a crystal radio receiver. The presence of the microammeter in parallel with the headphones results in some reduction in the volume of

Charles Golenpaul, president of the Radio Parts & Electronic Equipment Shows, Inc. (right) and Kenneth C. Prince, show manager, hang out the S.R.O. sign to indicate that all 168 exhibit booths at the 1948 Radio Parts show have been allotted. The Show, to be held at the Stevens Hotel, Chicago, May 11-14, promises to be the largest in the industry's history.



the signal in the headphones. However, during the author's tests, all signals were noticed to be sufficiently good even with the meter shunting the headphones to justify this simplified connection scheme, rather than the installation of a second 2-circuit jack.

Test Loop and Test Probe. Constructional details of these two accessories are given in Fig. 7.

In Fig. 7A, the coaxial cable is terminated at the instrument end by a male connector for insertion into jack J_3 (See Fig. 6). It is terminated at the other end by a 2-pin male connector into which may be plugged any one of several 2-contact female connectors (See Fig. 7A), each of which supports a copper wire ring to be used for inductive pickup. Several such mounted rings, covering a range of diameters, may be built.

With this arrangement, only one "loop cable" is needed, the various coupling rings being plugged successively, as required, into the end connector of the cable.

In Fig. 7B, the coaxial cable is terminated at its instrument end by a male connector for insertion into jack J_1 (See Fig. 6). The other end of the cable runs as far as possible into the test probe handle in order that the outer sheath of the cable may provide shielding from the operator's hand. The 4-$\mu\mu$fd. ceramic isolating condenser is connected by the shortest possible pigtail leads to the prod tip on one end and to the inner conductor of the cable on the other end. A small alligator clip is connected, for grounding purposes, to the outer sheath of the cable just before it enters the probe handle. This ground connector will not be needed in most transmitter checking, where signal voltages are rather high, but it will be of definite advantage when tracing a weak signal through receiver channels.

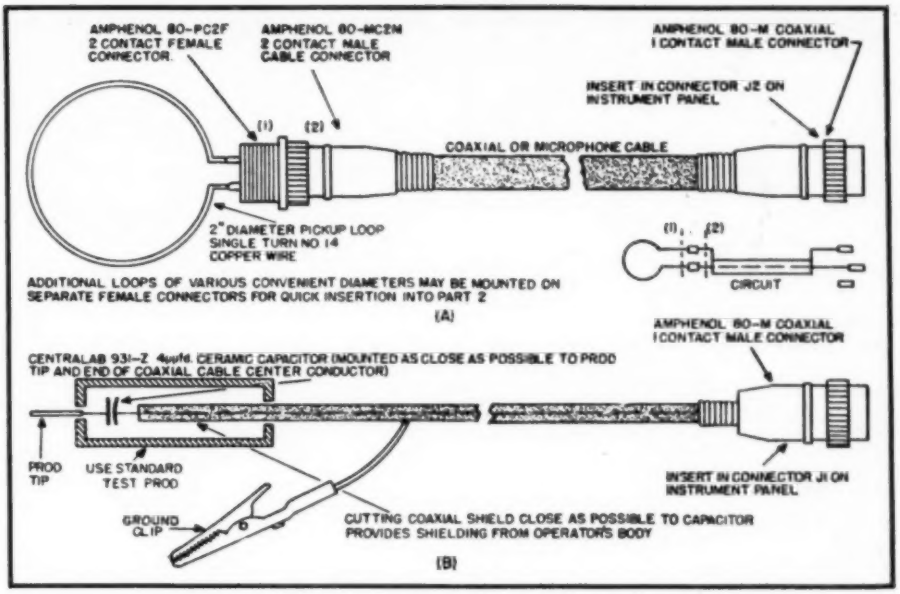


Fig. 7. (A) Pickup loop assembly. (B) Probe assembly.

Mechanical and Electrical Construction

The frequency checker is a simple instrument. The only possible complication is introduced by the coil switch. The remainder of the circuit is very rudimentary and accordingly should give the builder little difficulty. Because of the simplicity of the circuit, however, there may be a temptation to forego careful checking of the wiring, and the reader is cautioned against this probability.

It is important to observe strictly the crystal and meter polarities indicated in Fig. 6.

Short, direct leads should be employed in every position. The connection between the pole of switch section S_1 and the tuning condenser stators must be made with No. 14 bus wire, to prevent calibration shifts due to movement of this lead.

Bypass condenser C_4 is mounted directly to the microammeter terminals and rests on the back of the meter case. (See Fig. 3.)

Layout of the instrument is shown clearly in Figs. 1 and 3. A sloping front steel cabinet, 10" wide and 8" high, houses the author's instrument shown in the photograph, but this style may be varied by the individual builder. For example, a flat metal case, 10" wide, 8" high, and 4" deep, might be employed. Arrangement of the components on the front panel is shown in Fig. 1. Note that pin jacks J_3 and J_4 are mounted directly beneath the meter. Coaxial input jacks J_1 and J_2 are seen in the two lower corners of the front panel, and the range switch in the lower center portion of the panel. The range switch is shown in one of its *"OFF"* positions—between positions *B* and *C*.

Fig. 3 shows the arrangement of components behind the panel. All parts are mounted, as is seen, directly on the front panel, there being no need for a chassis.

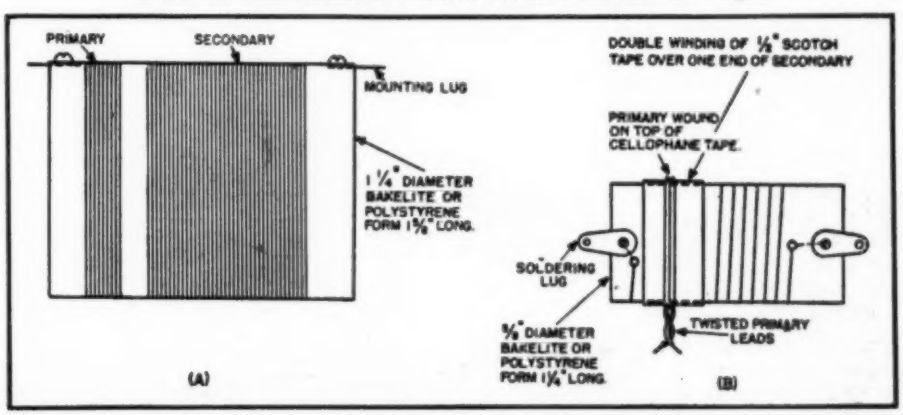
The special tuning dial is made from a regular 4-inch-diameter metal-plate dial with finger grip knob. The knob is removed from the plate and a 4-inch white Bristol board disc (ruled with two circles in black India ink—one of 1½" radius and the other of 1⅞" radius) is fastened to the plate with thinly-spread rubber cement. The knob then is replaced and the dial installed on the tuning condenser shaft. After the calibration points are marked in temporarily (See *"Calibration"*), the dial once again is removed, the knob taken off, and the graduations and figures rendered permanently in black India ink. After covering the drawn dial plate with a 4-inch protective disc of transparent plastic, the dial is reinstalled permanently.

A closeup of the installed dial is shown in Fig. 5. When installing the dial, the heavy radial line between the letters *A* and *D* and *B* and *C* is set flush with the indicator, with the tuning condenser set at maximum capacitance. This line is a convenient lineup point whenever the dial is removed and reinstalled.

The two dial indicators seen in Fig. 5 are cut from transparent plastic. The upper indicator is for the two top scales of the dial; the lower indicator for the two lower scales. This arrangement prevents the crowding which would result from placing all four scales above or below the knob. Dial readings are taken flush with the straight edge of each indicator.

The name plates are lettered in

Fig. 8. Mechanical details of coil construction. Winding data is given in the coil table on page 43. Construction of Coil A is shown on the left while details for Coils B, C, and D are shown at right.



black India ink on thin white Bristol board and fastened to the front panel with thinly-spread rubber cement.

In calibrating the dial, follow this procedure:

(1) Connect a radio-frequency signal generator or test oscillator to input jack J_2. This must be a *direct* connection, not one made through a condenser, pickup coil, or probe.

(2) Set range switch S_1-S_2 to position *A*.

(3) Set oscillator to 400 kc. and advance attenuator in oscillator to maximum output position.

(4) Tune frequency checker dial for maximum deflection of microammeter. Mark this dial setting in pencil.

(5) Advance oscillator frequency to 420 kc., tune-in with signal checker, and mark this point on signal checker dial.

(6) Repeat at as many points as possible up to 1200 kc.

(7) Turn switch S_1-S_2 to position *B* and repeat procedure for as many frequency points as possible from 1100 to 3200 kc.

(8) Turn switch S_1-S_2 to position *C* and repeat procedure for the 3 to 10 mc. range.

(9) Turn switch S_1-S_2 to position *D* and repeat procedure for the 8 to 30 mc. range.

Applications

Absorption Wavemeter (inductively-coupled). Plug loop cable into input jack J_2. Plug pickup ring of desirable diameter into receptacle at other end of loop cable. Set range switch S_1-S_2 to range *A*. Place pickup ring near coil in transmitter or oscillator under test, using loose coupling. Tune dial for maximum deflection of microammeter. At this point, read unknown frequency on instrument dial. When searching for an unknown frequency, always set range switch S_1-S_2 to the *lowest* range, *A*, and progress to each high-frequency range until resonance is obtained. Tune the dial from the lowest to the highest frequency, and take the lowest-frequency indication encountered. In this way, a harmonic will not be spotted erroneously as the true signal. If meter deflection is excessive, reduce coupling between ring and coil in transmitter or oscillator.

Probe-Type Wavemeter. Plug probe cable into input jack J_1. Set range switch S_1-S_2 to range *A*. Touch probe tip to circuit point under test and tune instrument, from lowest to highest frequency, until the resonant point is indicated by maximum deflection of the microammeter. If resonance is not found, set range switch to next higher frequency range and retune dial from low to high frequency extremes. When resonance is obtained, read unknown frequency on frequency checker dial. If meter deflection is excessive, remove test prod from circuit under test, increasing separation to reduce meter reading.

Signal Tracer. Use in the same manner as a tube-type channel analyzer: Connect r.f. test oscillator to antenna and ground terminals of receiver. Plug probe cable into input jack J_1 of signal checker. Connect ground clip of test probe to receiver chassis. Set oscillator to some convenient frequency within receiver tuning range (say, 1000 kc.). Touch test prod tip to antenna terminal and tune-in oscillator signal with signal checker.

After three months of swishing back and forth in solution in this tank, these synthetic ethylene diamine tartrate piezoelectric crystals are now ready for "harvesting" at the Western Electric Company's Electronics Shops at Allentown, Pa. These crystals in that time have grown from tiny seeds and will now be processed into piezoelectric crystal plates which will be used as filters in long-distance telephone circuits. The process for "growing" these crystals was developed by Bell Lab scientists after ten years of investigation and research.

Transfer probe tip to first grid terminal and tune receiver for maximum deflection of microammeter in frequency checker. Transfer probe tip to output circuit of first receiver stage, noting meter deflection and retuning instrument if necessary. Repeat at input and output of each receiver stage, r.f., detector, i.f., and oscillator, following the signal through from antenna terminal to second detector. If meter deflection is excessive at any point, reduce test oscillator attenuator setting, noting difference between calibrated attenuator readings for determination of stage gain ratio.

Phone Monitor. Set up instrument as described under *Absorption Wavemeter.* Tune-in transmitter with pick-up ring lying on operating table in front of signal checker (unless transmitter is extremely low powered, this will provide sufficient pickup). If meter deflection is excessive, move loop (ring) to a new position farther from the transmitter. If meter reading changes during modulation, carrier shift is indicated. Plug headphones into pin jacks J_3 and J_4 to monitor modulation quality.

Crystal Radio Receiver. Use with headphones, as outlined under *Phone Monitor,* except connect outside antenna *direct* to center terminal of input jack J_2, and ground to instrument case. Tune-in stations with instrument dial.

Field Strength Meter. Use as outlined under *Radio Receiver,* except remove headphones. The antenna for this application may be a short vertical rod of copper or brass, or may be a portable doublet. When the signal checker is used as a field strength meter, it will be desirable to make a direct "microvolts" calibration of the microammeter. For this purpose, set up the instrument in the manner outlined under *Calibration* and plot a curve showing microammeter deflections for various microvolts settings of the calibrated attenuator in the r.f. test oscillator or signal generator. -30-

"OLD TIMERS' NITE"

THE Delaware Valley Radio Association of Trenton, New Jersey, is sponsoring its Fourth Annual "Old Timers' Nite" and banquet on Saturday, March 27th.

The affair will be stag and will be held in the Terrace Room of the Stacy-Trent Hotel, West State and Willow Sts. in Trenton. A turkey dinner will be served at 6:30 p.m.

Guest speakers will include old timers in the wireless field and prominent members of the radio fraternity. Door prizes will be awarded and a special award will go to the "Grand OM" whose radio experience dates back to the earliest days of wireless.

Reservations should be made with Ed. G. Raser, W2ZI, Ticket Committee Chairman, 315 Beechwood Avenue, Trenton 8, New Jersey, before March 20th. Tickets are $4.00 per person until March 20th with latecomers having to shell out $5.00 for a ticket purchased at the door. -30-

Radio Industry Report

(*Continued from page 45*)

sales volume, total employment, and plant investment are very large, radio really is a "small business" industry, composed mostly of small manufacturers. There are a half dozen large set manufacturers, but the industry actually is composed of scores of small parts and set companies and suppliers. Radio has made few fortunes, but many failures. Ours is a highly competitive, even a "cut throat" industry. It has been often said that there has been more money lost than was ever made in radio manufacturing. In 1927 there were about 290 manufacturers in the membership of our Association. Of these there have survived only 51 companies on our membership roster, and conditions today, since the entrance of many new manufacturers during the war production program, are at their competitive peak.

The American public has a large, present financial investment in millions of phonographs and combination radio-phonograph sets, both standard and the new improved FM receivers. Such public investment amounted, in the last five civilian production years, to $1,251,700,000.

According to the annual report of the Federal Communications Commission radio set ownership among the American people is estimated at 73,000,000. There is at least one radio receiver in 91 per-cent, or in 34,800,000 of the 38,000,000, American homes. Average home ownership is about two radio receivers.

In 1947 the radio industry had an all-time record production of about 18,000,000 sets compared with a previous high, in 1946, of 16,000,000 sets of all kinds. For the information of the committee and for future reference a summary of industry statistics is given in Table 1. These figures represent production in 1940, 1941, part of 1942, and the years 1946 and 1947. The war stopped civilian radio production in April, 1942 and it was not resumed until late in 1945, so that 1946 was the first postwar year of volume production. Also, radio sets and parts were under OPA price control until October 31, 1946, and these controls interfered with normal production until finally the OPA was ended.

The new FM broadcasting was developed shortly before the war. There were only 48 FM stations on the air when civilian radio production was halted in 1942. FM had (and still has) great promise and expectations, and in 1946 FM gained impetus by the production of 181,000 sets with a retail value of $61,700,000. FM had the official endorsement of the Federal Communications Commission and its rapid national expansion was expected. Hundreds of station applications were filed, including many from ex-servicemen. But limited receivers in use at the outset necessarily afforded FM stations limited financial advertising support and possible expenditures for musicians.

The anticipated expansion of FM was slowed down appreciably and definitely by the AFM edict prohibiting the standard broadcast networks from duplicating their music for the new, financially-weak FM stations. Thus there were no network musical programs available on FM and this substantially reduced production and sales of FM receivers and transmitters.

Just a year ago the Federal Communications Commission predicted that there would be "more than 700 FM stations on the air" by the end of 1947. Actually there are 379 such stations in operation, or about 46 percent less than expected by the FCC and the industry, and a large section of the nation's population is still without FM service.

Last March the radio industry had a survey made by an independent certified public accountant agency to estimate our 1947 production of FM receivers. This survey indicated that the industry would produce 2,666,000 of the new FM receivers last year. Largely as the result of the inability of the new FM broadcasters to secure network music on their programs, the industry's 1947 FM production totaled about 1,150,000 FM receivers, less than half of the anticipated 1947 production.

Industry production of television receivers in the last five years totaled 183,000 sets with a retail value of approximately $104,800,000. A tremendous television expansion in 1948 and future years is in prospect. Competent industry estimates are that a half a million television receivers or more will be produced in 1948 with a value of possibly a quarter of a billion dollars.

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One of the last official acts performed by the retiring chief of Indianapolis' Fire Department, Harry Fulmer, was the inauguration of that city's new two-way Motorola FM radiotelephone fire communications system. Incoming Fire Chief Roscoe A. McKinney and Mayor-elect Al Feeney are interested spectators as Chief Fulmer dispatches the first messages to firemen.

Birth of a Service Note

(*Continued from page* 50)

acteristics. Five of the sets are then released to the service laboratory.

At this point the service technician really goes to work—he carefully records voltages, resistance, gain per stage, and other characteristics of the circuit. He develops an alignment procedure using precision laboratory equipment. This procedure must be simple. Sometimes as many as 10 separate service and alignment techniques and procedures are developed and discarded until a simple and foolproof method of approach is found.

Once the correct method is determined, the technique is then transferred to *standard test equipment* like that generally found in the average dealer's radio service shop. If the set cannot be serviced using this type of equipment, the technician develops succeeding procedures until a satisfactory application is obtained. This cut-and-try and weeding-out process continues until a simple, straightforward service technique—one that can be performed by the *average radio serviceman* using only *average radio test equipment*—is developed for each model.

As the development of the service technique progresses, the laboratory technician makes notes concerning the location of trimmers, adjustment screws, etc. When the essential service information has been obtained from a critical analysis of the set, the laboratory technician and draftsman work together to be certain that all pertinent information is included in laying out the necessary service schematic and other drawings. Differing from the complex shop schematic developed by the engineering department the service schematic uses a minimum of lines and crossovers, and has "sufficient air" between the parts for easy reference. Together, the technician and draftsman confer on the under chassis view and other explanatory drawings. Trimmers and test points are labeled. All parts are shown in their proper physical position and location.

If the circuit design is radically different, the laboratory technician will "bug up" the circuit by introducing troubles such as short or open-circuiting certain condensers, windings, or resistors in order to determine what effect failure of these parts will have on the performance. This information may not be included as a part of the service note; it is usually made up as a troubleshooting chart that includes all models.

Once the technician and draftsman have completed their work, all data, alignment charts, and drawings are turned over to the technical writer who arranges them in Service Note format. At this time, the laboratory technician and technical writer go over the parts list, carefully checking the nomenclature to make certain that parts may be easily identified from the list of replacement or renewal parts, which is part of every Service Note. The technical writer is responsible for the arrangement and format of the finished product; the laboratory technician is responsible for the technical accuracy of the service data and drawings.

The "dummy" Service Note is then made up full size, with the placement of text and pictures indicated as "Fig. 1", "Copy A", "Copy B", etc. The type and style are specified for good legibility and ease in reading. Care is taken in the layout to place all drawings, particularly the schematic, near the charts so that it is not necessary to turn the page for reference.

After the printer completes a proof copy, the technical writer checks it over and may make a re-arrangement of the copy and illustrations for sake of clarity. The corrected proof is then returned to the printer and the presses roll.

So you see, from the time the engineers first conceive the idea for the "set of tomorrow" until the information for servicing the set is in the mail, the related efforts of the engineering, service, and time study departments, plus all the other people mentioned, are coordinated with one aim in mind—to have your service notes ready when you need them.

—30—

B.C. Super

(*Continued from page* 53)

connect the 5-volt winding to the filament, and take the high voltage from that winding in the conventional way instead of from the cathode as shown. However, if parts are being purchased to build this receiver it is wise to use the circuit exactly as shown, since a saving in the purchase price will be effected.

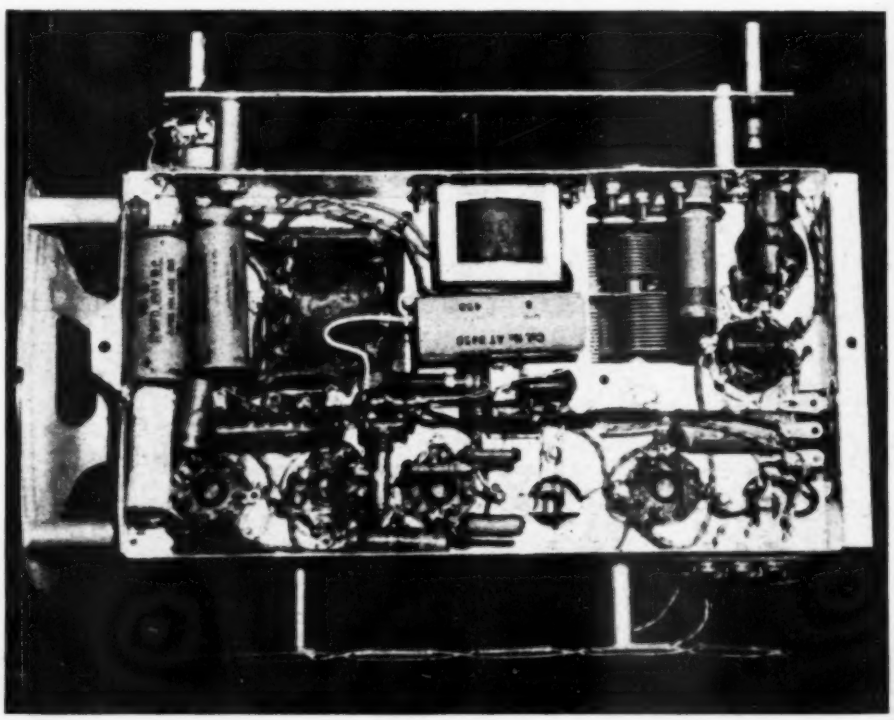
After the filaments are wired and tested, the author advocates building the set backwards starting at the output tube, and testing each stage as built, but this is not absolutely necessary. It is merely a foolproof system to avoid the possibility of wiring mistakes which are, to say the least, a bit irritating when it comes to troubleshooting with limited test equipment. The circuit is so simple and straightforward, however, that no trouble should be experienced; years of production of this model have, as mentioned before, virtually eliminated all the "bugs."

The oscillator coil, L_1, seen soldered to the chassis lip in the extreme right top corner, is of the cathode tap variety, and should be placed in this position for best results. Shielding of any sort was found unnecessary with this layout, so adherence to it will no doubt save a possible headache or two from mutual coupling. With the coils shown, the standard type of "tracking" condenser (using a special oscillator section) works very nicely, tracking and adjustment being simplicity itself. After the entire circuit is wired, the i.f. section can be aligned, if necessary, by ear, providing the i.f. transformers have not been misaligned prior to installation. Peak them, by means of the trimmers in the cans, for maximum-gain hiss, then, if no signal generator is available, tune the dial to the high end (about 1400 kc.) finding a fairly good local signal whose frequency is known. By means of the trimmer condenser on the tuning gang, next adjust the frequency until it agrees with the proper dial setting for that station. Now peak the loop (mixer grid) with its trimmer for maximum gain, and the receiver is ready to go. Of course, if the equipment is available, by all means align your receiver by the approved method, using, if possible, an output meter and a good signal generator.

In the interests of long life performance and economy the author used only components of the highest quality, and adherence to this little point will not only cost but little more, but will insure trouble-free performance for years. Incidentally, the filters shown, while not quite up to the recommended values, result in such a low hum level that no annoyance has been experienced from this score. The larger values of filter capacity that are available nowadays cheaply are, however, advisable. The ones used in this set were employed because the "big babies" just weren't to be had at the time, due to war-scarce conditions.

As a final word, while the neatness of parts layout under the chassis isn't necessary, it doesn't hurt anything, and it makes for much easier initial wiring, as well as maintenance, etc. Anyway, it's no harder to do a neat job than a haywire one, so a bit of care where it can't be seen will pay off in, at least, personal satisfaction in a job well done. —30—

Under chassis view of completed home-built, broadcast-band receiver.



FM Tuner

(*Continued from page 47*)

is superregenerating, a rushing noise will be heard in the loudspeaker. If this noise does not develop adjust the variable resistor R_1 until it does.

Adjust the frequency of the 6J6 stage to approximately 31 mc. Adjust the plate circuit of the 6BE6 to the same frequency. When the 6BE6 plate circuit is tuned, a noticeable decrease in noise will result. Space the two coils so that only a slight decrease in noise takes place when this adjustment is made.

Place the variable condenser in approximately its center position. Connect a signal generator to the antenna coil, setting the frequency of the generator to 100 mc. Adjust trimmers C_2 and C_5 for maximum output. Adjust the variable resistor in the plate circuit of the 6J6 for optimum operation considering signal-to-noise ratio.

Condenser C_{14} and resistor R_7 determine the squelch frequency. If a tube type other than the 6J6 is used it may be necessary to change the values of C_{14} and R_7. Select values that give maximum sensitivity with good signal-to-noise ratio.

As the values of C_{14} and R_7 are increased the squelch frequency decreases.. This can result in the production of a squelch frequency in the audible range which is highly undesirable. If such a condition does exist, a high pitched note will be heard at all times. Reducing the values of C_{14} and R_7 will increase this frequency thus eliminating the whistle.

If a signal generator is not available, the following procedure can be used to align the FM tuner. Tune a receiver to 31 mc. Connect a short piece of wire to the antenna post of the receiver and place this piece of wire near the tuner. Tune the tank circuit of the 6J6 stage so that noise is heard at 31 mc., using the receiver as a monitor. Tune the trimmer in the plate circuit of the 6BE6 to a point where this control affects the rushing noise of the receiver monitor. This will indicate that the plate circuit of the 6BE6 is tuned to the same frequency as the 6J6 stage.

Use a frequency meter or wavemeter to establish the oscillator frequency at approximately 69 mc. Next adjust the 6BE6 grid trimmer for maximum noise.

Although this method is definitely on the crude side, it will place the tuner in sufficient alignment to make final adjustments on a received signal.

The antenna for the FM tuner is dictated by circumstances. If sufficient signal strength is available from a local station, a short piece of wire inside the house will give satisfactory reception. On the other hand, if the FM transmitters are located several miles distant, an outside antenna is

desirable. The flat ribbon folded dipole antenna is economical and quite effective. Where distant reception is necessary, a beam type antenna is recommended.

The antenna connection to the tuner should be made directly to the one turn antenna coil. If a terminal strip is mounted on the chassis, both terminals should be insulated. A piece of transmission line is required to connect the antenna coil to the terminal strip.

If shielded transmission line is used for this connection, solder the shield to ground and the center conductor to the free end of the antenna coil. The ground connection should be made as close to the ground end of the antenna coil as possible.

Unshielded transmission line is connected to the antenna coil in the same manner.

The transmission line impedance will be dictated by the impedance of the receiving antenna.

The sensitivity of the tuner is in excess of one microvolt. That is, a signal intensity of one microvolt can be heard. To reduce the superregeneration rush to a desirable level, a signal of 25 microvolts is necessary. As the signal strength is increased above this level, little change in audio output is realized. There is a definite a.v.c. characteristic to a superregeneration stage as the sensitivity of the stage falls off radically as the signal strength increases. This effect reduces static and ignition noise.

The frequency response of this tuner is usually in excess of that found in an audio amplifier used in the average AM receiver. The first noticeable difference between AM and FM reception, using the same audio amplifier, will be a decided increase in high frequency response.

Of course the high fidelity capabilities of this unit are necessarily limited by the audio amplifier, speaker, and speaker baffle used in conjunction with the tuner.

The use of this type of tuner is not limited to broadcast FM reception. Such units can be constructed as standby receivers for emergency service, both AM and FM. Radio amateurs will find many applications for such equipment as they explore the new high frequency bands now open for ham operation. By substituting different type converter stages, adapters can be operated at extremely high frequencies with sensitivity in the order of a few microvolts.

The simplicity of the circuit is such that experimenters with a very limited amount of receiver design experience can expect to construct such a unit with satisfactory results.

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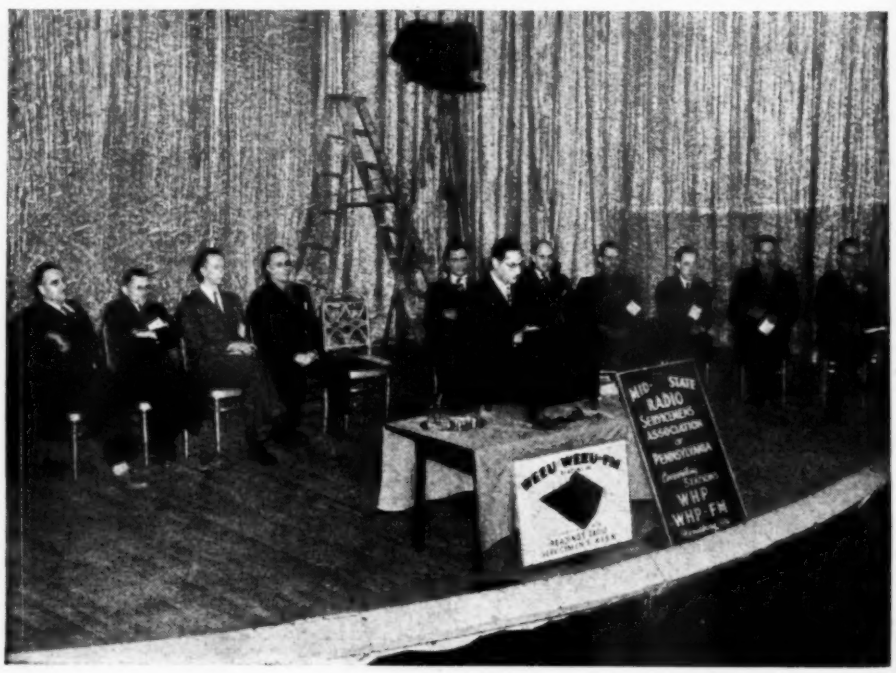
The recently held convention of the Federation of Radio Servicemen's Associations of Pennsylvania found this group of chapter presidents gathered on the speakers' platform at one of the sessions. From left to right: T. L. Clarkson, Harrisburg, Vice-president, Mid State Radio Servicemen's Association; Leroy J. Link, President, Reading Radio Servicemen's Association; John Lackman, South Bend, Indiana, State Representative, Radio Electronic Technicians Association; Del Bruner, Secretary, Akron Radio Technicians Association; A. R. Guild, Williamsport, Association of Radio Servicemen of Central Pennsylvania; Dave Krantz, President, Philadelphia Radio Servicemen Association (standing at rostrum); J. A. Renville, ex-officio delegate, Luzerne County Radio Servicemen Association; B. A. Bregenzer, President, Pittsburgh Radio Servicemen Association; Max Liebowitz, President, Associated Radio Servicemen of New York; David Van Nest, President, Radio Servicemen's Association of Trenton; and H. D. Keiderling, Director, Lehigh Valley Radio Servicemen's Association and North Jersey Radio Servicemen's Association.



Technical BOOKS

"DIAL CORD STRINGING GUIDE" compiled and published by *Howard W. Sams & Co., Inc.*, Indianapolis, Indiana. 100 pages. Price $.75.

One of the most time consuming yet least profitable phases of the radio servicing business involves the repair or replacement of dial cords.

In order to eliminate costly delays in restringing dials, the authors have produced this handy-sized book which illustrates clearly and easily how to repair dial cords in radio receivers produced from 1937 through 1946.

Easy-to-follow diagrams and text show each step clearly and accurately. Hundreds of receivers of various manufacture are listed by model number and then the corresponding diagram is given for each model. The diagrams are complete and explicit and by following the step-by-step instructions even the knottiest dial cord problem should be untangled easily.

* * *

"MOST-OFTEN-NEEDED 1948 RADIO DIAGRAMS" compiled by M. N. Beitman. Published by *Supreme Publications*, Chicago. 192 pages. Price $2.00.

This latest publication is number 8 in the series of diagram manuals published by *Supreme*.

The compiler has gathered together schematics, alignment data, replacement parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing for almost all of the new 1948 home receivers.

The products of over fifty radio and phonograph manufacturers are included in this new manual which should provide fairly adequate coverage of sets likely to be encountered in the radio service shop.

* * *

"AN APPROACH TO RADIO" by J. B. Shrewsbury. Published by *Electronic Industries*, Princeton, Ky. 288 pages. Price $4.50.

This text has been designed for the layman and the beginning student of radio. The author has presented the subject of radio in an informal, easy-to-read style which is conducive to further study of the subject.

Mathematics has been purposely omitted except where absolutely necessary to an understanding of the subject. Familiar analogies have been used extensively to clarify the operation of a radio receiver.

The book is divided into eight chapters dealing with radio transmission and reception, the audio oscillator, beat note receiver, audio amplifier, receivers for modulated signals, receiver development, transmitter development, and power for transmitters and receivers.

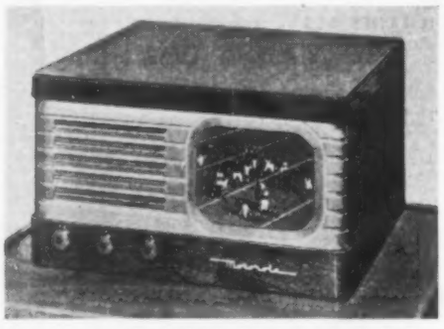
The book is enthusiastically recommended for the layman, beginner, or the high school instructor. —30—

NEW RECEIVERS for Spring Market

LOW-COST TV RECEIVER

Distribution of the new *Motorola* table model television set is proceeding rapidly as the unit finds wide consumer acceptance in the field.

This new table model, which sells within the price range of the average buyer, has been designated the Model VT71. It is housed in either a walnut, blonde, or mahogany cabinet. Weighing only 26½ pounds complete, this new set may be easily carried about the house to provide television entertainment in any room where antenna



leads are available. Because of the light weight, special stands or tables are unnecessary.

The circuit uses 15 tubes, 2 rectifiers, and germanium crystal detector. The cathode-ray tube is of the 7" size giving a direct view image of approximately 26 square inches. Three controls, located on the front panel, are all that are required for the operation of the unit. There is an 8-position tuning knob and the set is adjustable to any eight of the 13 channels. The over-all cabinet dimensions are 9½" x 16⅜" x 16¾".

Full information on the VT71 will be provided on request to *Motorola, Inc.*, 4545 Augusta Boulevard, Chicago 51, Illinois.

PROJECTION TV

General Electric Company's Receiver Division is currently in production on a new projection television receiver, the Model 901.

This new unit projects an image 18 x 24 inches and in addition to television offers AM, FM, and short-wave coverage plus an automatic phonograph.

Using a five-inch cathode-ray tube, the image is reflected by means of the *Schmidt* optical system upon the reverse side of a translucent plastic screen. Sharp pictures are obtained by means of the company's "automatic clarifier" which virtually eliminates fuzzy edges and reduces the effects of interference interruptions, according to the manufacturer. This same circuit automatically controls picture synchronization.

Reception on all 13 television channels is assured with a separate circuit for each channel. Tuning the various channels is accomplished by turning the selector to the channel number on which the desired station operates. This feature makes it possible to move the set to any television service area in the country without having to make readjustments.

When not receiving television programs, the screen may be lowered into a concealing well in the top of the cabinet. Counterbalances make the raising and lowering of the screen effortless. The automatic phonograph is mounted on a roll-out drawer.

The Model 901 is housed in a cabinet of genuine Honduran mahogany and retails in the upper price bracket.

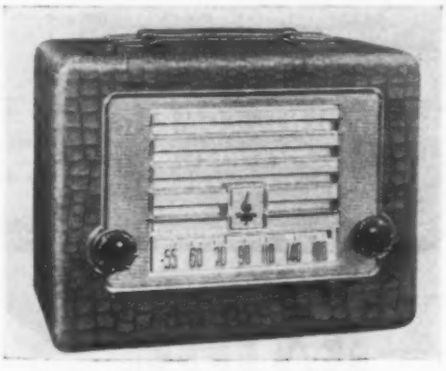
Further details on this console may be obtained from *General Electric Company*, Receiver Division, Electronics Park, Syracuse, New York.

EMERSON PORTABLE

Emerson Radio and Phonograph Corporation has recently introduced a new self-powered portable to retail in the low priced class.

Designated the Model 567, this new set is encased in rich grained leatherette with a rugged luggage-construction base. The receiver measures 8½" x 4¾" x 7½".

A full-sized Alnico V PM dynamic



speaker, especially designed for battery use, is employed in this radio.

Additional details on the new Model 567 are available from *Emerson Radio and Phonograph Corporation*, 111 Eighth Avenue, New York 11, New York.

PACKARD-BELL UNIT

Production on two new "top of the line" receivers which feature dual-turntables for copying of records is underway at *The Packard-Bell Company*, Los Angeles, Calif.

These "PhonOcord" combinations are available in walnut or mahogany finishes (The Wilshire) or in combed oak (The Fantasia). Both cabinets feature matched panels, a pull-out drawer containing the recording turntable, generous album storage space, and all hand-rubbed surfaces.

The "PhonOcord" includes two turntables, one a *Webster* No. 56 record-changer and the other a recording turntable. The radio circuit uses 12 tubes plus rectifier and tuning eye. FM coverage is provided by this unit along with a Hi-Q impedance loop

and FM dipole antennas. The 12" electrodynamic speaker floats on live rubber. The phonograph unit is equipped with a "Silentronic" crystal pickup, a lifetime needle, studio type wide range dynamic microphone, public address system, dual tone controls, and push-pull audio system.

Full details on either or both of these units may be secured by writing *The Packard-Bell Company*, Los Angeles, California.

PORTABLE RECORDER

One of the new series "Magnetape" recorders made by *Amplifier Corp. of America* that is receiving a lot of attention in the industry is the portable line.

Each portable system consists of a twin set of matched carrying cases covered in brown leatherette and equipped with special handles for easy portability. One case houses the completely self-contained recording and playback unit while the second case holds a sensitive microphone, microphone cable, extension line cord in addition to providing space for 25 reels of "Magnetape," "E-Z Cue," and cleaning and maintenance accessories.

Four different models are available in the portable series depending on the frequency response desired. A simple inverter easily adapts these recorders for 6 volt automobile operation. They will operate in any position, even upside down. External vibrations have no effect on the recording and reproduction progress, according to the company.

For additional technical information, including complete specifications and performance ratings, write to *Magnephone Division, Amplifier Corp.*

GIBSON GIRL EMERGENCY TRANSMITTER SCR 578A & B—Automatic or hand operated transmitting on 500 kc. No batteries required. Automatically transmits SOS signal. A wonderful buy at **$19.95**

Complete with box kite, parachute, 300 ft. extra antenna wire, extra lamp, 2 bulbs, 2 balloons (4 ft. dia.), hydrogen generator, 2 inflating tubes, instruction manual. Complete in large waterproof, felt lined carrying bag **$29.95**

Radio Compass Superhet Receiver R-5-ARN7

Complete with 15 tubes. Frequency range from 200 to 1750 kc. 115V, 400 cycles, power supply inc. Can be modified for broadcast reception; C.W. tonevoice. Special **$19.95**

FIELD TELEPHONES EE-8 & RM-29—Ideal for farm, warehouse, garage extension, or similar use; works on 2 flashlight cells. With handset, generator, ringer etc., in strong case. New only $14.95. Used. **$9.95**

72 Inch ANTENNA — 37-50 meg matching section; excellent for 10 meter band. Containing cylinder is 5" long, 3½" diameter, with coaxial cable loading coil. Can be adapted for FM and Television. Good for mobile or fixed station. New, Special **$2.45**

WHIP ANTENNA AN-131A—Half wave 40 to 48 meg. 10½ ft. long. Comes in 8 all brass sections, connected on a spring steel cable. Good for FM reception, mobile, or fixed station; can be converted to fishing rod. In original sealed carton. Brand New. Only **$1.49**

RECEIVER AN/CRW 2 & 2A—3 tubes (12SN7) including 28 volt DC dynamotor, 3 sensitive relays. Can be used for controlling purposes **$3.49**

CABLE—Single conductor, 7 strand #10 gauge, rubber insulated, armored with 18 strands steel wire, with heavy outside rubber cover; overall diameter ¾"; reels contain approx. 6,000 feet; weight 3300 lbs.; has many uses in wire communication; 100 ft. min. ..... 15c foot
Discount for larger quantities.

Standard Lip Microphone T-45 — complete with PL291A plug; ready for use. Instruction book included. New 49c

Throat Mike T-30—double throat type; PL-291 plug. M199 neckband. Works into any 200 ohm impedance input circuit. Instruction sheet included. 39c

HS-23 Headset—8000 ohm impedance, PL-54 plug 98c

HS-33 Headset—600 ohm impedance. 98c

KELLOGG operator transmitter microphone T-28E; adjustable swivel and extension bracket, with special 10 ft. ES2526-8 cord. New $7.95

Telephone Receivers R-14—high impedance, light weight, watch case type, double magnet, black bakelite cap; no headband 59c

HEADSET P-19 with 2 R-15, 24,000 ohm high impedance receivers; includes 2 rubber cushions, PL-55 plug, 8 ft. cord. New, $2.39; Used $1.79

HANDMIKE T-17B—200 ohm, single button carbon mike, push button switch. Ideal for home transmitter or portable rig; 5 ft. rubber cord, plug and dust cover. Brand New 89c

HANDSET TS-13—200 ohm carbon mike, 2500 ohm earphone, 6 ft. rubber cord, 1-PL55 and 1-PL68 plugs attached. New $2.95

HANDSET TS-15A—200 ohm, same as above; can be used in intercom., radio & telephone work. Used $1.98

Brand New Motor Driven Gear Box—2—DC 24 volt motors shunt wound. Can be used as a low voltage AC motor from 8 to 24v input. Complete with micro switch, 50 gears and control box $4.50

Radio Compass Receiver BC-433G—Complete with 15 tubes; frequency range from 200 to 1750 kc. 115V, 400 cycles; power supply included $19.95

Write for Quantity Discounts
Prompt Delivery—Write Dept. RNM
25% Deposit Required on C.O.D. Orders
Shipped F.O.B. New York. Minimum Order $2.00

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564 ATLANTIC AVE.
BROOKLYN 17 NEW YORK

All Merchandise is War Surplus and is sold as used unless otherwise specified.

TUNING UNITS, BC-746—with 2 crystals; transmits on 3655 KC and receives 4110 KC; includes RF coil and antenna coil with variable padder; mounted on 1 base, wired and ready to plug in; carrying case included. Brand New **$2.29**

Thigh clamp transmitting key J-45—with 5 ft. cable and PL55 plug 49c

PLUGS—PL55 and PL68, each 12c

RADIO RECEIVER BC-1023A—Ultra High Frequency, covering 62 to 80 mc range. An extremely sensitive relay, works on 4/10 of mil. Contains 4 tubes: 12SH7, 6SQ7, 6SC7, 6U6TG. New **$3.95**

G.E. 50 watt ceramic tube sockets; for 211-838, 250T.H. and other type tubes. New, each **79c**

PARACHUTE—12 ft. in diameter, with over 70 sq. ft. of orange colored silk or nylon. Can be used for wearing apparel and many other things. Also included 192 ft. heavy white nylon cord, 15 ft. of 1¼" webbing, 3 safety snap buckles. Brand New **$4.95**

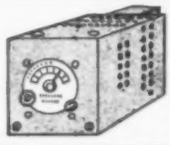
SA-260U—Beautiful black plastic microphone switch; 2½" long, 1" diameter; push button make and break, press to signal. Screw type, can be used with or without case. Good for interoffice buzzer, closet lights, doorbells, phonograph recorder. Can be mounted or used by hand. Each 26c

Quantity prices on request.

LARGEST WAR SURPLUS STORE IN AMERICA • **NO MAIL ORDERS FILLED FOR LESS THAN $2.00**

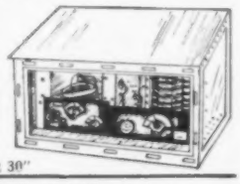
SCR 522 TRANSMITTER RECEIVER
Designed to operate from 100-156 mc. Makes an ideal 2 meter rig **$14.95**

1206B BEACON RECEIVER
Six tube superhet, 200 to 400 kilocycles. **$4.95**



I-82 A INDICATOR
Radio compass indicator. Ideal beam indicator **$2.85**

OUTDOOR TUNING UNIT
Type CA-730 used to couple simultaneous radio range, 400 watts. 70 ohm to 1 ohm.
$39.95
Case 43" x 32" x 30"

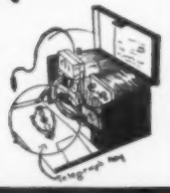


ROTARY SWITCH KIT 10 switches, some ceramic and bakelite wafers. **$2.49**

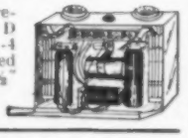
MICROPHONE CORD CD318 has switch SW-141 to which are attached 7 ft. Sig. C. Cordage. CO-145 has 1.68 ..... .25

TL 29 PEN KNIFE
Genuine U. S. Signal Corps knife. Has one blade and one locking screwdriver. No dealers—limit one to a customer **79c**

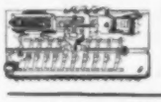
TG5-B TELEGRAPH SET
Made for U.S. Signal Corps. Equipped with key, buzzer, and ringer bell in a compact metal box. FREE: Canvas waterproof case with shoulder strap. (Batteries 95c extra) **$4.95**



BC 616 RELAY BOX
Contains 3-24 V relays, 1-150 MFD 50WV, 2 resistors, 1-4 terminal block, housed in aluminum box 6½" x 5½" x 2" **$1.79**



BK 22 E RELAY BLOCK
Contains 1-12 volt D.P.S.T. leach relay, 1-12 volt solenoid ratchet relay **95c**



1147 A U.H.F. SUPERHET RECEIVER
Has 4 acorn tubes, 2 gang butterfly cond., single dial control, 2 stages of I.F. coverage 100 to 160 megacycles **$7.95**
Less power supply.

MICROPHONE STAND
Banquet type. Brand new. Purchased from U.S. Army **$2.95**

MOUNTING FT 151A aluminum plate with 6 lord, 14 lb. shock mounts ..... .95
RESISTOR KITS ½ to 2 watts—50 various usable values ..... .95
25 Mica Condensers various usable values ..... .95

ALL MERCHANDISE SHIPPED F.O.B. PHILA.

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AT 8th & ALLEGHENY PHILA. 40, PA.

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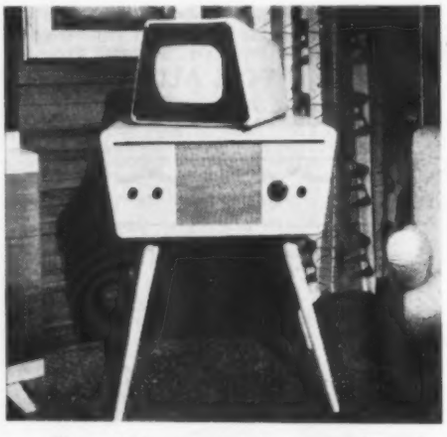
of America, 398-2 Broadway, New York 13, N. Y.

THE "HOLLYWOOD"

Cleervue Television Corporation's new "Hollywood" model television receiver has several eyecatching and newsworthy features that will appeal to buyers.

Housed in a modern cabinet, the new receiver features a 12" direct view swivel screen that can be focused 180 degrees in any direction. In addition, the receiver is constructed to include a five-deck chassis which is virtually five separate instruments, thus reducing servicing problems to a minimum. Each of these chassis sections are plug-in units which can be removed and replaced instantly. All repairs on the unit are performed at the service agency.

The 30-tube set is broken down into five chassis; the r.f. unit, power supply, video chassis, audio chassis, and sweep deck and high voltage. The receiver covers all 13 channels assigned to video broadcasting. There are four stages of video i.f., two stages of video amplification, and a three-stage sync separator and clipper. Five front panel controls include intensity and



on-off switch, contrast control, volume, station selector, and vertical hold.

Additional details on the "Hollywood" will be supplied on request by *Cleervue Television Corporation,* 81 Willoughby St., Brooklyn 1, New York.

RCA TABLE MODEL TV

The *RCA Victor Division* of *Radio Corporation of America* has just announced its new Model 8TS 30 table model television receiver featuring the largest speaker ever employed in an *RCA Victor* table model TV unit.

The unit features a 5 x 7 inch elliptical PM speaker, mounted to the cabinet which, according to the company, results in increased volume and improved tone, particularly in the bass response.

Cabinet styling includes the elimination of grille cloth and the substitution of fine louvres in a wing-like formation on either side of the 10 inch picture tube. A relief border of brass is used between the louvres and the solid portion of the cabinet front, and golden-trimmed tuning knobs are employed. The 52-square inch picture is mounted in a light-toned frame. The set is available in mahogany, walnut, and blonde finishes.

Further details on the Model 8TS

30 will be supplied on request by the *RCA Victor Division, Radio Corporation of America,* Camden, New Jersey.

GAROD TV

Delivery on *Garod Electronics Corporation's* new "Royal" five-in-one television combination was begun recently with the instrument featuring a 12" direct viewing tube, AM, FM, short-wave, and automatic record changer, all housed in a mahogany finished 18th Century cabinet.

Garod Electronics Corporation, 70 Washington Street, Brooklyn 1, New York will supply additional details on the "Royal" upon request.

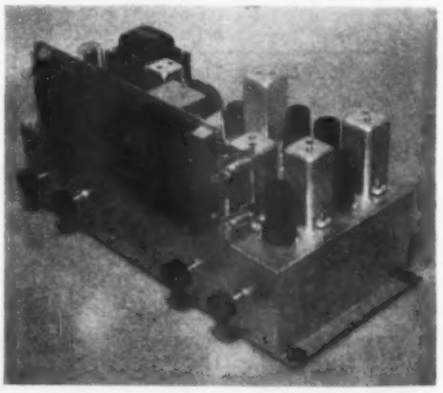
FM-AM TUNER

Dongene Laboratories, Inc., of New York City has recently introduced a 13-tube FM-AM tuner to the trade.

The new tuner has a range of from 88 to 108 mc. for the new FM band and from 530 to 1700 kc. in the standard broadcast band. The FM section utilizes a two-tube cascade limiter for maximum noise rejection and three miniature type tubes are used in the FM front end, with a separate triode oscillator.

Temperature compensated ceramic condensers are used throughout the FM section to minimize frequency drift. The FM i.f. coils are wound on ceramic coil forms and are slug tuned.

The FM antenna input is designed for use with a 300 ohm line. No coil



switching is utilized as separate r.f. and i.f. systems have been incorporated for FM and AM.

Further details on this tuner may be secured from *Dongene Laborato-*

ries, Inc., 85 Van Dam Street, New York 13, New York.

NEW CAPEHART

The addition of the Model 115N2 "Modern" to the *Capehart* line of home receivers has been announced by *Farnsworth Television & Radio Corporation* of Fort Wayne, Indiana.

Housed in a genuine mahogany cabinet of contemporary design, the new unit is available in either bisque or cordovan finishes.

The dual unit radio and amplifier chassis has 21 tubes plus two rectifier tubes, a tuning eye and a tuning eye amplifier. Broadcast bands are provided for AM, FM, and short-wave reception. The two speakers, a 15-inch for low frequency and a 5-inch for high frequency, are coaxially mounted.

The receiver employs the *Capehart* record changer which plays up to 32 selections, from 3 to 16 records, 10" and 12" intermixed, continuously and without reloading, turning them over in proper sequence or playing one side only as desired.

Further details on the Model 115N2 may be secured from *Farnsworth Television & Radio Corporation,* Fort Wayne, Indiana.

PHILCO COMBINATION

Philco Corporation has recently introduced a new radio-phonograph combination console which will retail in the moderate price class.

Featuring a powerful receiver with improved superheterodyne circuit, PM dynamic speaker for high undistorted sound output of both radio and rec-

ords, plus a quiet, smooth-action automatic record changer that plays up to 12 records, the new Model 1282 is housed in a cabinet of striped mahogany in a classic-modern design.

Prices and additional details on the Model 1282 will be supplied upon request to *Philco Corporation,* Philadelphia, Pa.

TABLE COMBINATION

Stromberg-Carlson has a new table model radio-phonograph unit in its 1948 line which includes several features usually associated with console receivers.

A three-gang condenser provides big set performance and selectivity, while the built-in loop antenna gives

improved reception. A 5¼" permanent magnet Alnico V speaker combined with a cabinet of correct acoustical design assures excellent tone and a minimum of unwanted sounds. The receiver has three controls in-

cluding the on-off volume; phono bass, phono treble, radio treble and radio bass; and a station selector switch.

The cabinet is of hand-rubbed striped walnut veneer with an etched aluminum escutcheon grille of functional design. The over-all size is 12⅛" x 15¾" x 16³⁄₁₆".

The automatic record changer plays both 10 and 12 inch records intermixed and stops automatically when the last record has been played.

Stromberg-Carlson, Rochester, New York, will supply further details on the Model 1101-HPW.

DELCO AUTO RADIO

The outstanding feature of the new *Delco* auto radio is the use of an ingenious "Electro-Tuner Control" which is said to eliminate the need for push-button tuning and dial manipulation.

With the new electromechanical control, mounted on the steering column, the driver need not take his eye from the road to tune in any station desired. A touch of the finger will "trap" and tune in stations, one by one, automatically.

Designated the *Delco* Model R-705, this set combines sensitivity, tone, and

power output comparable to a home receiver, according to the manufacturers. There are 8 tubes in addition to a synchronous vibrator, a push-pull audio system, separate 7" PM speaker, and tone and sensitivity controls.

This unit can be used in all makes of cars and trucks and can be transferred from one vehicle to another with minimum of trouble.

The new receiver is being marketed by *United Motors Service*. —30—

The MiniTran

(*Continued from page 65*)

other advantage of the Pierce oscillator is that neutralization is not required in the 6AQ5.

On 40 meters the very first station called, which was located in Tennessee, was worked from Connecticut. The following week seven states were contacted on 80 and 40. Reports as high as RST589X were received up to 300 miles away.

For the one evening's time and effort spent in constructing the "Mini-Tran" it has proven very worthwhile and should fill the bill for an emergency transmitter, and also a portable for next year's vacation.

-30-

PRSMA HANDLES COMPLAINTS

A FORWARD step in the self-regulation of the service business is being taken by the Philadelphia Radio Service Men's Association.

All complaints received by PRSMA, radio stations, or the Better Business Bureau are handled by a complaint committee appointed by the Board of Governors of the association.

The investigating committee calls on the complaining customer and examines the radio equipment in question. They also examine the bill if one was given the customer and proceed to contact the serviceman or company which performed the work. If the committee finds the serviceman is at fault he is given a reasonable time in which to correct the trouble. If he does not make the correction within the allotted time, the equipment is taken to the shop of a member for proper repairs and then returned to the customer. The original serviceman is then billed for this work. If he does not pay the bill and give complete assurance of mending his ways he is dropped from PRSMA membership and notice of this action is published in the association's house organ "PRSMA News."

Whenever a complaint is received through a broadcast station, the Better Business Bureau or any other similar organization, they are given a full report of the committee investigation as well as the action taken.

-30-

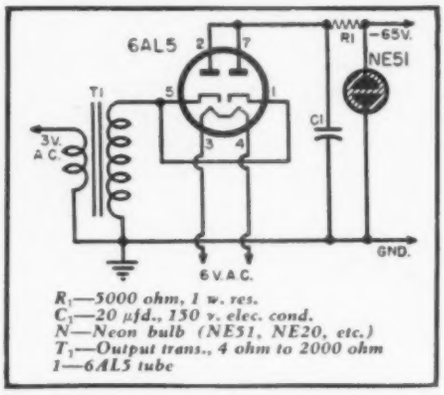
"Junior didn't like the way 'Gang Busters' turned out last night!"

A Compact Bias Supply

By J. F. CLEMENS, W9ERN

Unit will provide a 65 volt bias with a maximum grid current drain of 15 ma.

THERE are several ways of obtaining bias for a "class C" amplifier. In transmitters using small r.f. beam pentodes such as the 807, the desired compactness or economy usually necessitates a compact bias source. Because of the ease with which cathode bias may be employed, this method is often used in combination with a grid leak arrangement. The use of cathode bias has, however, several disadvantages. For one thing, if we use the 807 as an example, the key-up plate input must be limited to the safe rating for the tube, or 30 watts and at 600 plate volts. The plate current must, therefore, be about 50 ma. Assuming the screen current is negligible, and further assuming that about -30 volts bias is required for these conditions, the value of cathode resistance is 600 ohms. Under key-down conditions the bias may become -60 volts (at I_b = 100 ma.), and we have decreased our plate supply voltage by 60 volts. This operating bias may be too high to obtain maximum output since some resistance in the grid circuit is often demanded by other circuit considerations (i.e., perhaps to obtain broad tuning of the driver stage). A further disadvantage of cathode bias is the fact that the tube is in a condition of high sensitivity and there is often difficulty in securing freedom from parasitics. Also, the tube is likely to overheat at 30 watts dissipation (which occurs when the key is up) unless well-ventilated.



R_1—5000 ohm, 1 w. res.
C_1—20 μfd., 150 v. elec. cond.
N—Neon bulb (NE51, NE20, etc.)
T_1—Output trans., 4 ohm to 2000 ohm
1—6AL5 tube

Fig. 1.

To circumvent these difficulties, fixed bias may be employed. Battery bias is ideal in all respects except for the size, weight, and cost of the batteries. Since it is usually undesirable to use a separate full-sized bias supply, a side rectifier such as a 2X2/879 is often operated from the high voltage transformer. Here, the difficulty is in obtaining a low enough bias voltage, as it is uneconomical to use a large resistor to drop the bias from 600 volts or so to the proper operating value. Also, a separate winding on the filament transformer is usually demanded for the 2X2.

A compact power supply to fit the requirements of a typical 807 transmitter, formerly operated with cathode bias, is shown in Figs. 2 and 3. The small size (3½ x 2½ x 2) facilitates tucking the unit under the chassis of an existing transmitter. The compact size is obtained by using an audio output transformer, originally intended to match a 50L6 plate to 4 ohm voice coil, and a new miniature rectifier, the 6AL5. (See Fig. 1.)

Most of the small transformers of this type are designed to handle about 1 watt of audio @ 400 cycles. Ordinarily, it might be expected that this transformer would not be efficient at 60 cycles. It was reasoned, however, that the lack of the 50 ma. d.c. plate current in the primary (or secondary in this application) would enhance the efficiency to within reasonable limits. A test of the unit has shown it to be capable of doing the job without appreciable heating.

Fig. 2.

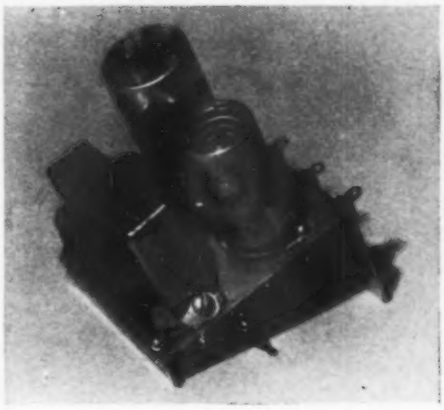


Fig. 3.

The voice coil of the transformer is operated at 3 volts input from the center tap to one side of the 6.3 volt filament supply. Since the turns ratio of the transformer is in the neighborhood of 20:1, the secondary delivers about 60 volts r.m.s. The condenser input circuit produces a d.c. voltage equal to the peak value of this wave, or about 85 volts.

A small resistorless neon bulb, mounted underneath the chassis, is used as a voltage regulator. Although the current through the neon bulb is somewhat less than 3 ma., a very light load in the power supply, the internal resistance of the bias supply is in the neighborhood of 200 ohms. Therefore, grid current of the "class C" stage will produce little fluctuation in the bias voltage.

The output voltage of the supply is approximately 65 volts although individual neon bulbs may vary from this value plus or minus 5 volts.

The current drain from the 3 volt source is approximately .4 amp.

Editor's Note: The current rating for a 6AL5 is 9 ma. per plate or a total of 18 ma. As there is a drain of 3 ma. in the neon regulator, the total grid current that can be accommodated is 15 ma. In using this type of bias supply care should be taken to use only those tubes requiring not more than 15 ma. grid drive. —30—

"And I still say that your new checker shouldn't take it upon itself to toss out a tube!"

TO COMBAT N. Y. LICENSING

THE newly organized Radio Servicemen's Association of New York has been formed for the purpose of establishing the professional standing of radio service technicians through ethical organization thus combating the proposals of City Councilman Isaacs for the licensing of radio technicians in New York City. The new group recently elected officers and established committees for the organization's activities.

Max Leibowitz of Mecca Radio and Electric Shop was named head of the new group. Norman Jacobson, Mid-City Radio and Phonograph Co., Inc., is serving as Vice-President. Jack Edel, Modern Radio Service, is the new Treasurer and Recording Secretary, while Harry Anis, of Harry's Radio Service, is the Corresponding Secretary. The attorney for the group is Gerald Nierenberg of Long Island City.

The program for the group includes the establishment of an investigation committee which will look into complaints of customers and evaluate them on a fair basis. Educational activities will include training in new radio maintenance techniques to keep members of the organization up-to-date in the field.

Emblems are being issued to member servicemen which they will display prominently in the windows of their shops. The public will be invited to look for the emblem of the association.

The members of the organization have agreed to a code of ethics which will correct many of the alleged abuses that have been attributed to the radio serviceman.

-30-

Interference Traps

(*Continued from page* 71)

The technique involved in employing these *wave traps* is that the trap circuit is *not* inserted in the antenna lead-in in the same manner as is the case with conventional traps. Note that the trap circuit is tightly coupled to the lead-in by virtue of the primary portion of each trap circuit which is actually connected in series with the transmission line. This broadens the band of effectiveness.

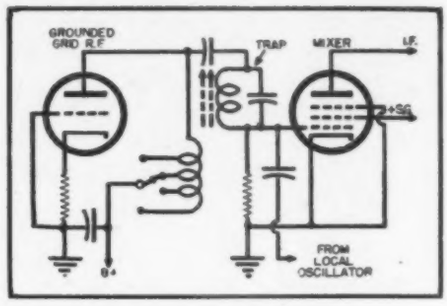


Fig. 8. Mixer grid input trap.

If the transmission line is a coaxial element then the two or more circuits can be coupled in series. (Fig. 2C). If the line is parallel, to a balanced input, then the two traps can be so wired that one circuit is in each leg and thus will not materially unbalance the antenna circuit. A considerably unbalanced condition would result in standing waves which give vertical light and dark areas that crowd up exponentially on the left hand side of the image. A detailed explanation for this phenomenon escapes this writer but it was eliminated when the line was balanced, so that the only reason that could be ascribed was the presence of standing waves in the unbalanced transmission system. The balanced line connection is shown in Fig. 2B.

Another method of connecting a trap circuit is shown in Fig. 8. This is inserted in the grid coupling system between the r.f. stage and mixer. In order to do this some means must be provided to get at the tuning element (an iron core or variable condenser). One such arrangement is possible with *National* type AR5 coils. Notice that a ground on the tuned circuit is to be avoided. If the range covered by these coils is not correct, wind your own on the type XR. They can be conveniently mounted on the chassis and will have an adjustment from the chassis top.

Employing any of the traps requires only the proper connection in the circuit and a careful study of the image while adjusting for minimum interference pattern.

-30-

Table 2.

CHANNEL (mc.)	IMAGE RANGE A	IMAGE RANGE B	SERVICES A	SERVICES B
54-60	40-52 mc.	27-39 mc.	Low-band FM, Amateur	Police, Amateur, Marine
60-66	46-58 mc.	33-45 mc.	Low-band FM, Amateur, TV Channel 2	Police, Low-band FM
66-72	52-64 mc.	39-51 mc.	TV Channels 2 and 3	Police, Low-band FM, Amateur
76-82	62-74 mc.	49-61 mc.	TV Channels 2, 3, and 4	Low-band FM, TV, Amateur
82-88	68-80 mc.	55-67 mc.	TV Channels 4 and 5	TV Channels 2 and 3

Spot Radio News

(*Continued from page* 20)

aspect of the industry—servicing. The day when you had to beg a repairman on bended knees to do anything for you should disappear soonest, in RMA's view, forcefully voiced recently by Max F. Balcom, RMA president. Mr. Balcom believes that it is "an encouraging sign that the radio servicing trade is vitally interested in doing something about" servicing, "a problem that has bothered the entire industry. While the radio service trade often has been the victim of unjust attacks and exaggerated complaints," he says, "we must admit that abuses do exist in varying degrees in a number of communities." The abuses are, generally, "incompetent workmanship, unnecessary replacement of receiver parts still in good working order, and charging for work not done." "These abuses," he adds, "are confined to a small minority of radio technicians and servicing shops, but just as a rotten apple may make a whole barrel of good apples suspect, so one unscrupulous shop can impair public confidence in the entire profession." Abuses have fallen off since the end of the war, he believes, but it is still necessary "that the industry clean house before some governmental or municipal agencies try to do it for us with far less satisfactory results." That the problem can be solved by the technicians themselves Mr. Balcom does not doubt. "We believe that radio technicians are best able to rid their ranks of the men and the abuses that bring discredit upon a vocation and an industry," he says. "Manufacturers will be able and willing to help wherever and however they can." There is plenty of work for everyone in the field, and the better they are, the more the opportunities, he adds. "The day when a handyman about the house could fix a radio with a screwdriver and a pair of pliers has passed," he points out, "Proper servicing requires more skill, greater familiarity with various types of test equipment, and more technical know-how than it did before the war." But the horizons for good men in the field are unlimited. "The radio technician is today in somewhat the same position as the automobile mechanic of twenty years ago. With the widespread increase in radio sets in the home, in the car, and outdoors, plus the growing use of mobile radio communication equipment by taxicabs, buses, et cetera, radio servicing is rapidly becoming a big business."

ALMOST SIMULTANEOUSLY, RMA has moved against legislative regulation of the servicing groups. When New York City recently proposed laws licensing technicians and servicemen, sponsors of the new rules were persuaded to defer action until the industry got a chance to set up a plan for self-regulation. RMA experts

under W. L. Parkinson of Syracuse, N.Y., immediately went to work and drew up various proposals for directing the public to good service shops. As this is written the program was going ahead rapidly and it looked as if it would be successful in heading off an avalanche of laws which, while catching bad servicing operators, would handicap the good with yards of red tape.

ONE THING RMA President Balcom overlooked in listing new radio services was a project that has gone beyond the experimental stage in Cincinnati. Station WCTS has put an FM set in a bus to amuse the customers. Last we heard, reception had proved excellent and a survey of bus riders indicates that 98 per-cent of them like the programs.

WE CAN BELIEVE that one about the FM reception on a moving vehicle, having recently done a little Joe Public experimenting ourselves with the new FM phone service on trains. Tried it the other day on the *Baltimore and Ohio's* "Royal Blue" from New York to Washington and the connection (from somewhere around Newark to Washington) was as clear as a bell. Making a call is almost as simple as putting in a long distance from a stationary booth. The operator on the train hooks up with the nearest mobile unit along the right of way, and from then on the call is put through in a routine fashion. Telephone numbers are different to include radio call letters—WR 02236, for instance—and some of the customers are slightly out of the ordinary, too, we learned. During the holidays there were a lot of college kids aboard and one group phoned a pal whose house was along the right of way. "Look out of the window," they yelled into the phone, "we're just about to come by on the train." Business calls are getting more and more frequent—average now on the New York-Washington run is eight—and a number of services are being worked out now that the phone is aboard. For example, *B & O* phones ahead from Wilmington on the Washington-Philadelphia run, so that when you get to the Philly station, if you desire, there is a taxi waiting for you in your name, eliminating battle with the guy who gets to it ahead of you. Service is done for free by the railroad, too.

IF YOU'RE PLANNING to do any experimenting with radar, be sure you are square with the FCC. The Commission recently issued a warning that any radar user must have both a station and an operator's license. Chief target of the warning is the college laboratory, where some radar work has been going on unlicensed. Training courses have also at times failed to sign up. The FCC precaution is to prevent interference with the transmitters of recognized radio services, particularly radio and radar navigational aids. —30—

Power Supply

(*Continued from page 51*)

a.c. input voltage (1.41 x E_{ac}). Condensers C_3 and C_4 each must have a minimum d.c. working voltage rating equal to *twice* the peak value of the a.c. input voltage (2.82 x E_{ac}).

The voltage quadrupler is symmetrical in configuration and therefore is comparatively easy to filter. While it has been common practice in previous literature to show these voltage multiplier circuits without output filters; the author strongly urges use of a filter, since most modern applications will not tolerate the ripple level resulting from totally unfiltered output. The current-voltage curves given in previous discussions likewise neglect the effect of voltage drop in a typical output filter. For this latter reason, the author has presented, in Fig. 4, a voltage-current curve made with a completely filtered power supply.

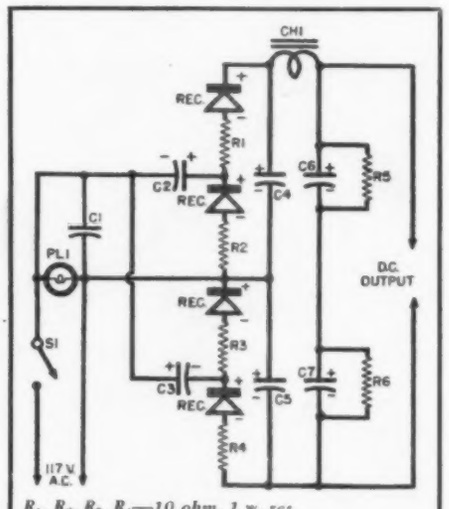
Complete Circuit

The complete circuit schematic of the transformerless, tubeless power supply is given in Fig. 3.

The basic voltage quadrupler components (as illustrated previously in Fig. 2) will be recognized here as the four selenium rectifiers (*REC*) and condensers C_2 through C_5. To this basic circuit has been added an output filter comprised of choke coil CH_1 and condensers, C_6 and C_7 connected in series to withstand the high d.c. output voltage. The ½ megohm shunt resistors, R_5 and R_6, equalize the d.c. voltage across the two filter condensers.

Resistors R_1, R_2, R_3, and R_4 are 10 ohm, 1 watt limiting resistors in-

Fig. 3. Circuit diagram of the complete power supply unit.



R_1, R_2, R_3, R_4—10 ohm, 1 w. res.
R_5, R_6—500,000 ohm, ½ w. res.
C_1—.1 μfd., 600 v. cond.
C_2, C_3, C_4, C_5, C_6, C_7—20 μfd., 450 v. miniature tub. elec. cond.
CH_1—8 hy., 150 ma. filter choke (Stancor C-1710 or equivalent)
PL_1—125 v., 6 w. pilot lamp
REC.—Selenium rectifier (Sylvania NC5)
S_1—S.p.s.t. toggle sw.

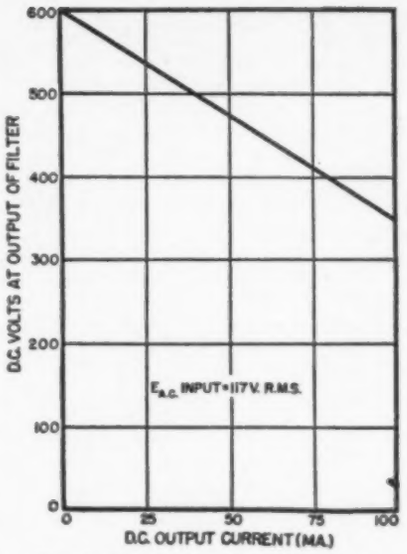


Fig. 4. Performance curve for power supply circuit shown in Fig. 3.

stalled for protection of the selenium rectifier units.

This power supply circuit delivers d.c. output voltages between 600 volts at no load (or very small load) and 360 volts at full 100 milliampere load. The variation of output voltage with load current is illustrated by the graph, Fig. 4. Close regulation of the d.c. output voltage may be obtained in a simple manner by means of gaseous voltage regulator tubes. Table 1 is a chart showing the most satisfactory combinations of series-connected VR type tubes to obtain regulated d.c. voltages of 300, 330, 360, 375, 405, and 450.

Construction

Fig. 1 shows two views of the complete power supply unit. These photographs show clearly the arrangement of all components listed in Fig. 3.

The power supply unit is built entirely on a 9½" x 5" x 3" steel chassis. This is a standard catalogue size. All of the components are mounted underneath the chassis which serves as an enclosing case. The front lip of the chassis (See Fig. 1) holds the *"ON-OFF"* switch and the 115-volt pilot light bullseye. The rear lip holds the d.c. terminal post strip and admits the rubber-insulated power line cord through a grommet-lined hole.

The four selenium rectifiers are seen mounted in line with each other in the lower portion of the chassis in Fig. 1. All four rectifier units have been mounted on a 6-32 threaded rod 3¼ inches long, passed through the central mounting hole of each rectifier, which is held to the chassis by means of a small metal angle bracket on each end of the rod.

The four quadrupler condensers (C_2 through C_5) are seen directly above the mounted rectifier stack, and the two output filter condensers (C_6 and C_7), pilot light bracket, and filter choke at the very top of the chassis.

Assembly and wiring of this power

Regulated D. C. Voltage	REGULATOR TUBES REQUIRED		
	OA3/VR75	OC3/VR105	OD3/VR150
300			2
330	1	1	1
360		2	1
375	1		2
405		1	2
450			3

Table 1. Voltage regulator combinations for the power supply unit.

supply unit is entirely straightforward and simple. Since only 60-cycle and d.c. voltages are involved in the operation of the unit, no assembly tricks are necessary. However, the 600 volt output terminals and the insulated wiring leading to them from condensers C_6 and C_7 must be kept well clear of the chassis. Terminal strips are employed liberally in construction of the unit, and wires are braided into a harness for neatness.

WARNING: The operator of this power supply unit must remember that it is capable of delivering an injurious electric shock. The pilot light is an important precautionary measure and should not be omitted by the builder. Because high capacitances are employed in this outfit, the output terminals are apt to be "hot" for a considerable time after the line voltage has been switched off. This is especially true when low values of output current are drawn. For this reason, it is advisable to short circuit the output terminals momentarily each time the *"ON-OFF"* switch has been thrown to its *"OFF"* position. This will discharge the condensers and protect the operator against shock.

As an additional safety measure, the chassis has not been connected to "B-minus" or to any other part of the circuit. The reader is advised to follow this scheme.

The author's power supply was built inside a small chassis for the sake of compactness. However, the individual builder may employ any housing which suits his fancy. For example, a small metal "instrument box" or cabinet might be used—or the unit could be mounted conveniently on and behind a narrow rack panel. There is no objection to using a wooden enclosure for the power supply, although it is a good idea to provide adequate ventilation, such as through a number of holes.

Applications

The power supply described in this article may be employed in all applications in which not more than 100 milliamperes load current will be required, and in which the degree of voltage regulation indicated by the curve in Fig. 4 can be tolerated. Its range of application may be further increased by employing voltage regulation (See Table 1). While the unit is shown here as operated from the 117-volt power line, it may be operated at any voltage between 0 and 117 volts r.m.s. Also, operation is not restricted to 60 cycles, since the

quadrupler will operate satisfactorily with very little variation in performance throughout the audio frequency spectrum.

Maximum output voltage is obtained when the load current is low. A typical application of this sort is the powering of a 2-inch oscilloscope tube. The full output of 600 volts may be obtained here because of the small current drain imposed by the Type 902 cathode-ray tube.

Typical applications of the power supply include the powering of radio receivers, small transmitter stages, oscillators, and test instruments. It may also be used as a voltage breakdown tester up to the limit of 600 volts, polarizer for electrolytic condenser forming in the radio service shop, for polarizing straight capacitance bridges, and as a general experimental power supply for the test bench.

The output voltage may best be varied from zero to maximum by plugging the power supply unit into a small *Variac,* and using the latter as the output voltage control.

—30—

TRANSMITTER EQUIPMENT SALES

SALES of transmitter equipment by RMA manufacturers totalled more than $97 million, the majority of which was U.S. Government business, during the first half of 1947, according to a report just released by the Radio Manufacturers Association.

Manufacturers of broadcast transmitting equipment received orders for $12,455,202 worth of transmitting and studio equipment and made deliveries on $9,253,358 of this equipment.

Of this figure, $3,325,570 represented orders for FM equipment with deliveries reaching $1,820,633 by member-companies in the first half of 1947. AM transmitter equipment totaled $2,402,768 and deliveries amounted to $2,319,006.

AM and FM studio equipment orders totalled $2,395,044 of which $2,205,382 worth was delivered. Antenna equipment for both AM and FM stations aggregated $1,597,541 in orders and $433,767 in deliveries.

Orders for television equipment, including studio, transmitter, and antenna, totalled $1,862,140 and deliveries amounted to $1,354,633.

—30—

Methods of Producing NEGATIVE POTENTIALS

By G. N. CARTER
Radio Service Mgr.,
G. A. Fletcher Music Co., Ltd.
Nanaimo, B. C., Canada

Circuits covered will supply negative potentials as high as 250 volts without requiring additional transformers.

IN SOME electronic circuits, particularly those in industrial equipment, a potential negative with respect to ground is required for biasing tubes to cut-off or beyond or in *RC* time constant circuits. Most servicemen are familiar with those used in receiving sets for audio tube control grid biasing from the "brute force" voltage divider circuits in the power supplies of the early days down to those in use today, such as cathode bias and "contact potential" used on the 6SQ7 and similar tubes. The two described in this article have been successfully used by the author for cut-off biasing and for *RC* time constant circuits. As will be noted, a minimum number of parts is used and an extra power transformer is not needed. Both systems allow the original power supply to generate its original positive voltage in relation to ground.

In Fig. 1, on the upper side of the diagram (*i.e.*, above ground lead), there is a conventional power supply with the voltage and polarities marked across the load resistor R_L. Coupled from one plate side of the high voltage winding of the power transformer is a diode connected as shown. The load resistors R_1 and R_2 are chosen so that no more than two milliamperes flows through this circuit, which current will not seriously unbalance the power supply. The voltage across the extremities of R_1 and R_2 will be approximately 250 volts with the polarities as shown, the arrow indicating electron flow. If R_1 and R_2 are 100,000 ohms each, 125 volts will be obtained at their junction with polarities as marked. By selecting different values of R_1 and R_2, and keeping their sum at 200,000 ohms, any voltage between 0 and 250 may be obtained, negative with respect to ground. Additional *RC* filters may be incorporated in the negative line if hum affects the connected circuit. The diode used may be a 6H6 with plates and cathodes in parallel, with the heater connected to the 6.3 volt supply. Any of the rectifier tubes with 6.3 volt heaters could be used such as the 6Z4 or the 1V. The 0Z4 could be used if filament current was a problem, but an r.f. filter might be necessary with this gaseous rectifier. The diode may be replaced with one

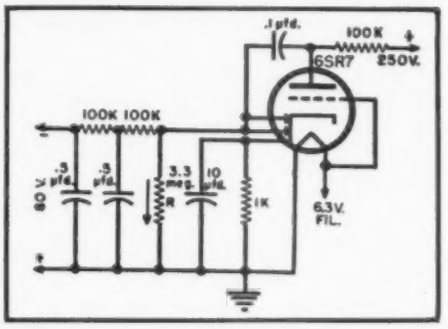
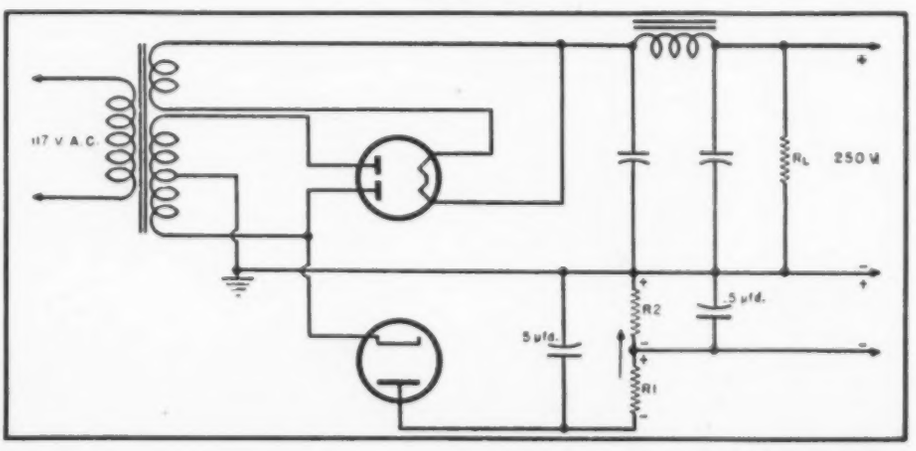


Fig. 2.

Fig. 1.



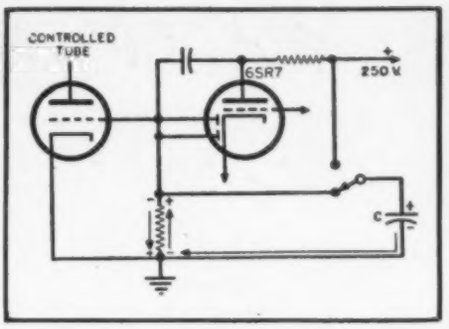


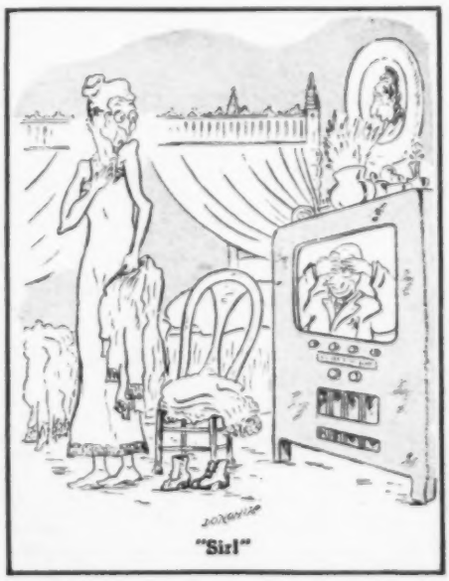
Fig. 3.

of the popular rectifiers now on the market for a.c.-d.c. receivers, provided suitable precautions are taken so that the inverse voltage on the rectifier does not exceed its specifications.

Fig. 2 shows a method of using a double diode-triode as an amplifier rectifier. The heater voltage is used as a source of a.c. applied to the grid of the triode and the amplified voltage is taken from the plate by a one-tenth microfarad condenser and applied to the two diodes connected together, the electron return path being through *R* to ground. Again, electron flow is shown by the arrow. Using a 6SR7 tube, with the optimum values shown, a voltage of 80 at the output of the filter, negative with respect to ground, may be obtained. Decreasing the value of *R* will lower this voltage. This is an ideal circuit for *RC* time delay, as *R* can be used as a condenser discharge path as shown in Fig. 3.

The discharge of condenser *C* passes through *R* in the direction shown by the right hand arrow, causing an electron flow in the reverse direction, reducing, cancelling, or reversing the voltage across the rectifier and allowing current to flow in the plate circuit of the control tube for a period related to the original voltage and the value of *R* and *C*.

Further applications of these circuits will suggest themselves to the experimenter or design engineer or for the replacement of batteries in existing equipment used to supply a negative potential. —30—



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Speech Blockade

(*Continued from page 61*)

improvement if it is considered sufficiently worthwhile. For instance, the program material may be stored while one analyzes it and in this way some of the shortcomings of the control circuit may be corrected. The program could be recorded on a wire recorder with playback facilities arranged to deliver it to a power amplifier and speaker a minute or two later. All program material would then be heard by the listener after a predetermined lapse of time, during which the analyzer circuit could more effectively determine whether the passage being recorded consisted of speech or music. If the circuit sensed that the material was predominantly music during any interval short interruptions could be ignored by it. In like manner, if the material was predominantly speech, then the occasional word or phrase which slips through with the circuit of Fig. 5 could be blocked. Fig. 2 is a block diagram of this arrangement.

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Atkins, Carl E. U.S. Patent No. 2,424,216 July 22, 1947.

—30—

SURPLUS SALES TO END

THE War Assets Administration has notified its agents that surplus electronic equipment sales through them will be terminated March 1st.

According to the WAA, should any inventory remain in the hands of these agencies after that date, it will be disposed of by donation to educational institutions in line with the program now applying to electronic inventories now on hand at the WAA.

While agency sales will be terminated, sale of surplus electronic equipment at the retail level will continue until stocks now in the hands of dealers are exhausted.

The WAA emphasized that there are still many types of end equipment, including components, tubes, etc., still available for sale. —30—

"Shymo just can't stand to have anyone stare at him!"

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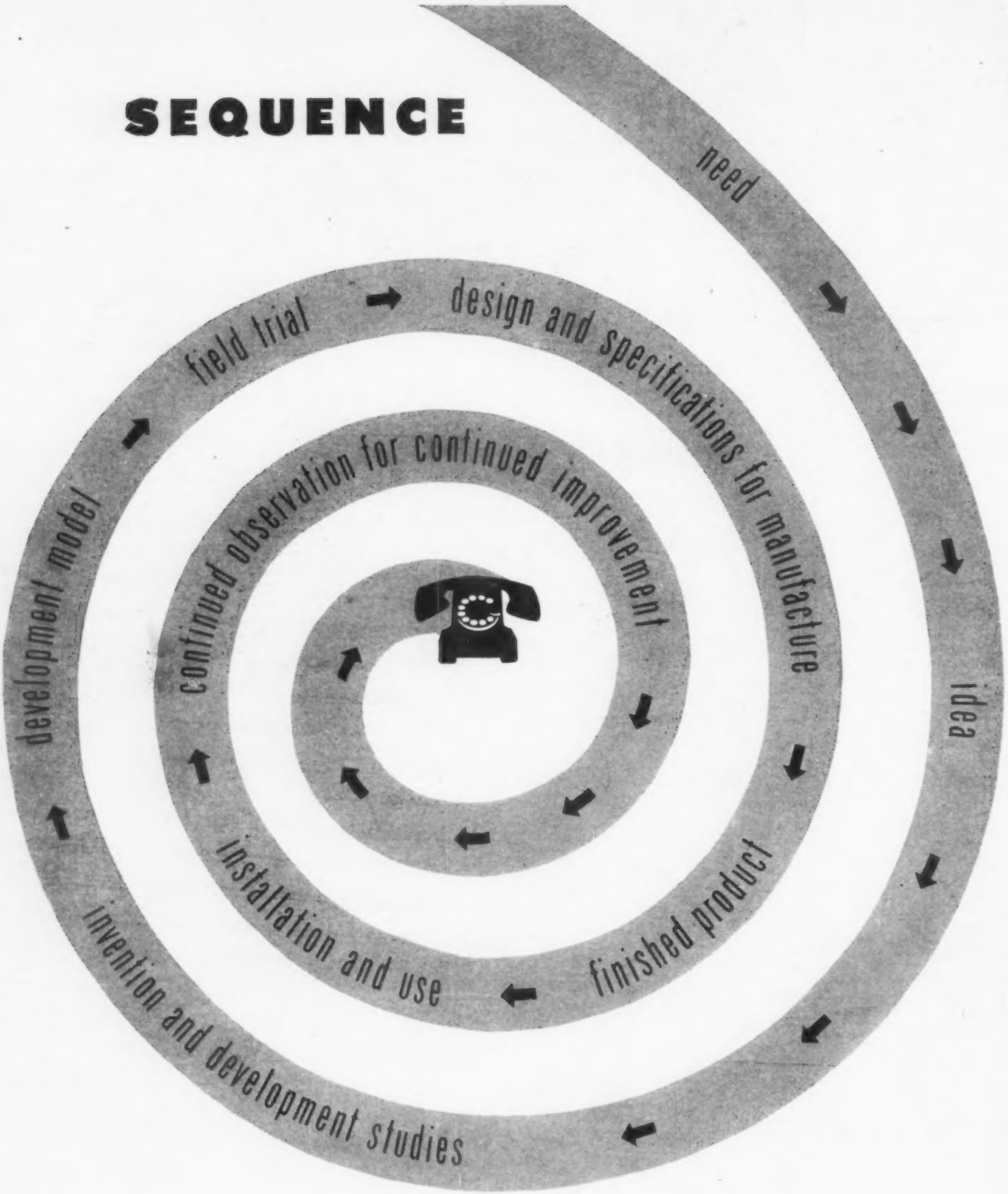

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